DOCUMENT RESUME

ED 264 141 SE 046 306

TITLE	Activities for Environmental Learning.
INSTITUTION	Pennsylvania State Dept. of Environmental Resources, Harrisburg. Bureau of State Parks.
PUB DATE	Nov 84
NOTE	121p.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	*Ecology; Elementary Secondary Education; *Environmental Education; Field Studies; Interdisciplinary Approach; *Learning Activities; *Outdoor Activities; *Problem Solving; *Science Activities; Science Education; Skill Development; Teaching Methods; Values
IDENTIFIERS	Environmental Ethic; Pennsylvania

ABSTRACT

This pre-school through grade 12 environmental education learning continuum was designed to help educators with a systematic method which develops an environmental ethic among students. It consists of: (1) preschool through third-grade activities (which stress environmental awareness and sensitivity); (2) intermediate level activities (which give students a basic understanding of ecological principles and concepts governing the environment, and an introduction to problem-solving skills and environmental valuing); and (3) secondary activities (in which students apply environmental knowledge and problem-solving skills to identify, investigate, and offer solutions to environmental problems). Each activity lists unit concepts, objectives, materials needed, major concept(s) fostered, appropriate grade levels, time needed, and season(s), and provides the procedures and instructional strategies for the lead-up, field, and follow-up activities. Student materials are included when applicable. Also included is a matrix cross-referencing nine concept areas by grade level. The concept areas are: environmental awareness; energy; cycles; diversity; community; interrelationships; adaptations; values; and problem-solving. (JN)

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Pennsylvania State Parks Activities for Environmental Learning

SE046306

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Purpose

This pre-school through grade 12 environmental education learning continuum has been designed to help educators with a systematic method which develops an environmental ethic among their students. The learning continuum consists of a package of materials which focuses on developing environmental knowledge, valuing and problem solving skills.

The pre-school through third grade activities stress environmental awareness and sensitivity. The intermediate level activities are geared such that students will gain a basic understanding of the ecological principles and concepts governing the environment. Students are also introduced to basic problem solving skills and environmental valuing at this level.

The secondary activities are designed to have students apply environmental knowledge and problem solving skills to identify, investigate and offer solutions to environmental problems. The secondary students are also exposed to concept-building activities. All the activities contained in this continuum stress student-centered learning. The activities encourage students to explore, do, think, question and make conclusions.

In addition to the activities developed by the Bureau of State Parks, activities from two other curriculums are included in the continuum, Project Learning Tree (PLT) and Outdoor Biological Instructional Strategies (OBIS).

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How to Use the Continuum

Concepts

The major concepts taught by the activities are listed across the top of the page. For the purposes of this continuum, the major concepts are defined in the following manner.

Concept 1: **Environmental Awareness** — Learning about one's environment is best done by direct student discovery using the senses.

Concept 2: **Energy** — The sun is the source of all energy. Energy is transferred in decreasing amounts from the sun to plants (producers) to animals (consumers) to plants and animals that recycle dead plants and animals (decomposers).

Concept 3: **Cycles** — Nutrients, the building materials of life, are used over and over again by plants and animals as they obtain them from and return them to reservoirs in the air, soil, water and all living things.

Concept 4: **Diversity** — A great number of different plants and animals exist to make best use of available energy and nutrients.

Concept 5: **Community** — Different plants and animals live together in areas that meet their special needs for energy and nutrients.

Concept 6: **Interrelationships** — All plants and animals interact with their surroundings and one another.

Concept 7: **Adaptations** — Over long periods of time plants and animals develop more successful ways for meeting their needs in the environments in which they live.

Concept 8: **Values** — People's differing opinions and actions toward the environment result in environmental problems. To successfully solve environmental problems, one must understand these differences.

Concept 9: **Problem Solving** — Environmental problems should be identified, studied and solved using action-oriented problem solving skills.

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Grade Level

The grade levels are listed on the left side of the matrix. To determine an appropriate activity for your class or group, match the grade level with the concept desired. The intersection of the horizontal and vertical columns identifies the best activities to use to develop a specific concept for that grade level.

Activities

The continuum is designed to provide students with different environmental learning experiences throughout their school careers. This scheme will avoid repetition of environmental learning experiences and enhance a sequence for acquiring environmental knowledge and problem solving skills.

The activities listed on the matrix have been drawn from three sources:

Bureau of State Parks (activities developed by the bureau and included in this notebook)

OBIS (Outdoor Biological Instructional Strategies, Delta Education, Inc., P. O. Box M, Nashua, NH 03061-6012)

PLT (Project Learning Tree, American Forest Institute, Inc., 1619 Massachusetts Ave., N.W., Washington, DC 20036)

This notebook contains descriptions and lesson plans only for the activities developed by the Bureau of State Parks. However, the state parks and environmental education centers that have programs offer all the activities listed on the matrix. For more information, contact the office nearest you.

Bureau of State Parks
P.O. Box 1467
Harrisburg, PA 17120
(717) 787-8800

State Parks Region 1
R.D. 1, Box 1-A
Emporium, PA 15834
(814) 486-3365

State Parks Region 2
Moraine State Park
R.D. 1
Prospect, PA 16052
(412) 865-2131

State Parks Region 3
Shawnee State Park
Schellsburg, PA 15559
(814) 733-2202

State Parks Region 4
R.D. 3, Box 91
Quakertown, PA 18951
(215) 257-3646

Environmental Education Centers

Nolde Forest EE Center
R.D. 1, Box 392
Reading, PA 19607
(215) 775-1411

Kings Gap EE Center
500 Kings Gap Road
Carlisle, PA 17013
(717) 486-5031

Jennings EE Center
R.D. 1
Slippery Rock, PA 16057
(412) 794-6011

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Activity Continuum

CONCEPTS	1	2	3	4	5	6	7	8	9
GRADE	**Environmental Awareness**	**Energy**	**Cycles**	**Diversity**	**Community**	**Inter-relationships**	**Adaptations**	**Values**	**Problem Solving**
Pre-school	Touchy-Feely (PLT) Using the Senses								
K	Touchy-Feely (PLT) Using the Senses								
1	Using the Senses Investigating Shapes and Patterns			Investigating Shapes and Patterns					
2	Plant Personification (PLT) Seasonal Changes			Leaf Hunt Relay (PLT)					
3	Seasonal Changes	Energy Transfer		The Closer You Look (PLT) Animal Traces Investigating Insects			Attention (OBIS) Animal Traces Investigating Insects	Choose an Environment (PLT)	
4	Creative Writing in the Outdoors	Animal Antifreeze (OBIS) Food Chain Game (OBIS)		Living Labels (PLT) Investigating Spiders Exploring Plant Communities	Terrestrial Hi-Lo (OBIS) Exploring Plant Communities	Forest Concentration (PLT)	Predator/Prey (OBIS) Seeds and their Adaptations Investigating Spiders	Creative Writing in the Outdoors	
5		Food Web Game		Plant Patterns (OBIS) Natural Community Profile Exploring Freshwater Communities	Natural Community Profile Exploring Freshwater Communities	Food Web Game Reading in the Outdoors Exploring Freshwater Communities	Toothpicking Bird Creepers and Climbers (OBIS) Plant and Animal Adaptations Birds and their Adaptations	Pioneers in the Wilderness (PLT)	How Many Animals Live Here?
6		Sound Off! (OBIS) The Weather Around Us	Long Range/Short Range (PLT) Investigating the Water Cycle and Watersheds	Exploring Habitats	Bean Bugs (OBIS) Forest Consequences (PLT) Settlers in the Wilderness Exploring the Soil Exploring Habitats	Reading in the Outdoors Exploring the Soil Exploring Habitats		Vacation Homes (PLT) Forest Consequences (PLT)	Outdoor Problem Solving Math and Compass
7-9					Settlers in the Wilderness				Outdoor Problem Solving
10-12									Water Quality Monitoring Environmental Forum Environmental Careers

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Activities

These activities have been developed by the Bureau of State Parks and are included in this notebook. For information on the OBIS and PLT activities, see the previous section, *How to Use the Continuum.*

Animal Traces — Students discover animal tracks, foods, homes and scat in soil, forest and water. Discussion centers on why animals choose specific areas for their homes. *Grades 1—3, Concepts 4,6,7.*

Birds and Their Adaptations — Students examine bird study skins for adaptations and discuss adaptations and habitats of birds observed during field observation. *Grades 4—6, Concept 7.*

Creative Writing in the Outdoors — The writings of Frost, Dickinson, Muir and others in the outdoors serve as inspiration as students write nouns, verbs, adjectives and poems to describe their discoveries. *Grades 4—6, Concept 1.*

Exploring Freshwater Communities — Students discover the inhabitants of pond or stream, aquatic animal adaptations, construct food chains and food webs and determine the quality of water investigated. *Grades 4—6, Concepts 5,6,7.*

Exploring Habitats — Students identify members of plant and animal communities in forest or field areas and discuss the interrelationships of plants and animals living in the area. *Grades 5—6, Concepts 2,5,6.*

Exploring Plant Communities — Students examine flowering and nonflowering plants in an area and determine the roles each plant fulfills in that area. *Grades 4—6, Concepts 4,5,6.*

Exploring the Soil — Students in small groups determine soil color, texture, permeability, temperature, and pH and the slope of the topography. Data collected is discussed in regard to soil fertility, plants and animals present, erosion potential and use by humans. *Grades 5—6, Concepts 3,5,6.*

How Many Animals Live Here? — Students estimate a population of animals (grasshoppers) found in an area using the capture, mark, release and recapture population estimate method. *Grades 5—12, Concept 9.*

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Investigating Insects — Students examine different types of insects, their adaptations, life stages, and interrelationships with other plants and animals to determine the role of insects in the environment. *Grades 3—6, Concepts 4,6,7.*

Investigating Shapes and Patterns — Students discover basic concepts concerning numbers, shapes, patterns and textures through first-hand discovery of the natural environment. *K—3, Concept 1.*

Investigating Spiders — Students examine different types of spiders, webs, spider adaptations and prey to determine spiders' role in the environment. *Grades 3—6, Concepts 4,7.*

Investigating the Water Cycle And Watersheds — Students simulate the water cycle, discover what a watershed is, discuss water uses and how humans affect watersheds. *Grades 4—6, Concept 3.*

Math and Compass — Students learn how to use a compass and determine their pace. Using this information the students negotiate a prescribed compass course through the forest. *Grades 5—6, Concept 9.*

Natural Community Profile — Students determine the plant and animal members of a forest community, discuss the roles in the forest community and compare the forest community to a human community. *Grades 4—6, Concepts 4,5,6.*

Outdoor Problem Solving — Students are introduced to the problem solving process through a series of tasks which stress group communications, cooperation and problem solving skills. *Grades 6—12, Concept 9.*

Plant and Animal Adaptations — Students examine adaptations of plants and animals from forest, field and aquatic habitats to discover how adapations help the plants and animals survive where they live. *Grades 4—6, Concept 7.*

Reading in the Outdoors — Students learn basic ecological concepts and practice reading skills by reading and discussing a story about Ralph, the red-tailed hawk and the changing seasons. *Grades 5—6, Concepts 5,6,7.*

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Seasonal Changes — Students examine the environment for signs that show how the changing seasons affect plants and animals and how plants and animals prepare for the different seasons. *Grades 1—3, Concept 1.*

Seeds and Their Adaptations — Students investigate various types of seeds and seed dispersal methods used by flowering plants. *Grades 4—6, Concept 7.*

Settlers in the Wilderness — Students role play early settlers and investigate the soil, plants and animals of a field site to determine whether the site is suitable for them to homestead. *Grades 5—6, Concepts 5,6.*

Using the Senses — Students use the five senses to discover the environment around them. Tasks include identifying colors, shapes, textures, smells and sounds. *Pre-school—1, Concept 1.*

The Weather Around Us — Students measure and discuss the components that make up weather and make a 24-hour weather prediction. *Grades 5—6, Concepts 2,3.*

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Animal Traces

UNIT CONCEPTS

- Animals make their homes where they are best able to meet their needs.
- Animals depend on plants, animals and the nonliving parts of their environment for their survival.
- A large number of animals are found in an area making the best use of available energy and nutrients.

OBJECTIVES

- List two animals or animal traces found in the soil and give two advantages these animals have in living in the soil.
- List two animals or animal traces found at ground level and give two advantages these animals have in living on the ground.
- List two animals or animal traces found in trees or shrubs and give two advantages these animals have in living in trees and shrubs.
- List two animals or animal traces found in the water and give two advantages these animals have in living in the water.

MATERIALS

strainers
trowels
paper
lapboards
plastic containers
bug boxes
hand lenses
pencil

MAJOR CONCEPTS

Diversity
Interrelationships
Adaptations

GRADE

1–3

TIME

1.5 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

- Have students bring in pictures of animals they think they will find on their learning experience. Have them find out what their animals eat, where they live, how they protect themselves, etc.
- Explain to the students that we can find out what animals are found in an area without seeing them by finding other evidence of their presence. What evidence might we find? (Examples are tracks, homes, droppings, eating areas.) Explore the school yard or nearby areas for signs of animals. Make a list of what you find.

Facilitators note: For each of the stops you should get off of the trail and have the students explore each area for animals and animal signs in groups of three. At least 15 minutes should be spent at each stop. Please have students replace soil, rocks, etc. after exploring.

Field Activity

1 Today we are going to find out what animals live in Nolde forest. To do that we will be exploring different areas of the forest. What animals do you think we will find today? (Make a list.) Is there any way we can tell if animals are around other than seeing them? (We may hear them or find tracks, droppings, trails, food remains, homes.)

2 **Soil Stop.** Pass out equipment to student groups. Have each group dig into the duff, humus and soil to discover animals or animal signs. If they can capture the animal have them put it in a plastic container. Each group should draw a picture of each animal found and state what advantages each animal has in living in that area.

Form a sharing circle and have groups show the animals they discovered and give the advantages these animals have for the places they live. Have students return animals to their homes and replace soil into holes.

3 **Ground Stop.** Have each group examine leaf litter, downed tree limbs and logs for animals and animal signs. Either have groups draw the animal signs, or during sharing circle have them show the sign they found to the whole group. Captured animals should be placed in plastic containers.

Repeat sharing circle. How are the animals or signs of animals we found on the ground different from those found in the soil?

4 **Shrub Stop.** Stop in an area of shrubs. Have student groups explore shrubs for animals and animal signs. Have students be especially aware of animal homes and evidence of animals eating. Be sure to aid them in their discoveries. Have students draw their animals and state what advantages the animals have in living here.

Repeat sharing circle and return animals.

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5 Tree Stop. Look up! Have student groups explore trees for animals and signs of animals. Be especially aware of nests and holes in trees. Have them draw pictures of what they find.

Repeat the sharing circle and return any animals to their homes.

6 Water Stop. Stop at an approved stream study site. Give each group a strainer. Have each group capture two animals. Have the group again draw a picture of its animals.

Repeat sharing circle. What makes these animals different from all the animals we have found so far? Did any groups find any animal signs near or in the water? (possibility of muskrat hole, turtle log, duck nest, etc.)

7 Silent Stop. Stop in an area away from the stream and other groups. Have each student find a spot s/he likes. Students should at least be several yards apart. Have them sit quietly for 5 to 10 minutes.

Form a sharing circle. What sounds did they hear? What animals made them? Did anyone see any animals?

8 Last Stop. Have student groups total up the number of animals they found. Also total up the number of animal signs they found. Were there more animals or animal signs found? What kinds of animals did we generally find just signs of? (Mammals, nocturnal) Why?

Were there any animals or animal signs found in just one place? Why? Were there any animals or animal signs found in more than one place? What enables them to use different areas?

Were there more animals found than what you thought or less? Let's compare our original list to what we found. What animals didn't we find that you thought we would? Why? Which animals did we find that you didn't list? Are there more "big" animals or "little" animals? Did you think we would find animals all the places we looked? Why or why not?

How did the various animals we found make use of the areas they lived in? Some examples might be: rotted log as a home for ants; nut shells as food for squirrels; deer trail as a highway for deer, etc.

Have each student relate what animal or animal sign s/he liked best.

Follow-Up Activity

- Return to the school yard. See if the students can find more animals and animal signs in the school yard than they did during their first investigation.
- People meet their needs too in the area they live. How do people meet their needs for transportation, food, water, shelter, waste disposal? Can you find human traces? They help us understand how we meet our needs to survive.

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Birds and Their Adaptations

UNIT CONCEPTS

- Birds possess several characteristics that differentiate them from other animals.
- An adaptation is a genetically programmed feature of a plant or animal that gives an animal or plant an advantage in meeting its needs for survival and reproduction.
- Bill, wing, feet, and tail adaptations in various bird species enable these species to fill specific niches in their communities.
- Bird populations play an important part in maintaining the ecological balance of a community.

OBJECTIVES

- List six characteristics that distinguish birds from other animals.
- Define adaptation.
- List four types of adaptations birds possess.
- For each type of adaptation, state two examples and state how that adaptation helps its owner survive.
- Construct a bird food web given a number of bird species and their food preferences.

MATERIALS

bird study skins
binoculars
paper
pencil
bird field guides
string
bird food web cards

MAJOR CONCEPTS

Adaptations

GRADE

4 - 6

TIME

2 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

Have students keep a list of birds they see for several weeks before the field activity. Include on the list where they saw each bird and what it was doing. How are the birds observed different and the same?

Field Activity

1 Today we are going to be learning about birds. To do that we are going to look at some study skins of birds inside and then we will go outside to look for birds in the forest.

2 Gather your group in a circle and pass a bird study skin around the group. Allow them as much time as they would like to examine the bird.

How is this bird different from other animals? For each answer have them state how these different things help birds.
bills—eating
scaled feet—grasping tree limbs, catching prey, swimming
wings—flight
feathers—flight
lays eggs—reproduction
hollow bones—flight

3 What do these differences help birds do? (These differences add another dimension to their world—air. Flight enables them to use the environment in which they live more effectively.)
These differences are called **adaptations.** An adaptation is any inherited physical characteristic that gives a plant or animal an advantage in meeting its needs for survival.

4 Let us look at these adaptations more closely. Pass out several more study skins and bird parts that exhibit various types of bills, wings, tails, feet.

First let us look at the beaks of the birds we have. Have students describe bills and their uses. (short, thick—crushing seeds; slender, pointed—picking up insects; long, slender—probing in mud or flowers; strong, sharp, hooked—tearing flesh; flat, broad—straining; short, stout—ground feeding; long, sharp, pointed—spearing)

Next let's examine bird feet. Have students describe feet and their uses. (three toes front, one back—perching; long legs, slender toes—wading, keep from sinking in mud; heavy, strong, curved sharp claws or talons—grasping prey; webbed—swimming; two toes front, two toes back—climbing; claws strong, blunt—scratching.)

Let's now examine the wings. Have students describe wings and their uses. (long, pointed—fast, easy flight; long broad—for strong soaring, easy flight; short, rounded—fast flight for short distances.)

Finally we will examine tails. Have students describe tails and uses. Tails provide balance in perching and flying, as rudders and brakes in flying; some are more specialized—strong, spine-like tips—support in climbing; broad, fanned—soaring; long, forked—extreme maneuverability)

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5 Now that we are somewhat familiar with birds, we are going out to observe some wild birds. Give each student a pencil and data sheet. For each bird observed, record the type of bill, feet, tail and wings, and any other distinguishing marks or behavior. (You may identify the bird with students if you like; however, the objective of the lesson is adaptations, not bird identification, so knowing all your birds is not a prerequisite for a successful activity.)

6 Were birds with similar adaptations found in the same places? Did all types of birds favor a certain type of area over another? Did you find any other evidence of birds? (You may find feathers, nests, droppings, dusting areas, tracks, hear calls, owl or hawk pellets.) Based on the bird's characteristics and where you found it, what might the bird be eating? (You may want to check foods in field guide.)

7 Birds eat a variety of seeds, berries and animal life. Let's see just how important birds are to the environment. Pass out bird food web cards. Place the sun in the middle; other students form a circle around the sun facing center. Make all interactions between birds and food sources by passing string between all predator/prey relationships. To show importance of birds, drop a bird out of circle. What effect does it have? (Rather than just saying "Dropping red-tailed hawks affects these other animals," trace the animals the change affects and deduce some results. For instance, eliminating red-tailed hawks may save a few rabbits; however, it may mean a lot more mice. Mice eat grain, so they might reduce grain harvest. When the grain is gone they may move to other food sources — your house.)

8 What role do birds play in the environment? (important predators, who along with other predators help keep prey populations in balance; they are indicators of our environmental well-being.) How do birds fill this role? (Different birds have various adaptations that help them fill various niches in the communities in which they live.)

Follow-Up Activity

- Build a bird feeder and observe birds at school.
- Build nestboxes for bluebirds, wrens, swallows and other birds and place them in suitable habitat.
- Study birds that are endangered and the problems they are encountering.

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Birds and Their Adaptations

Bird Data Sheet

Name	Type of bill	Type of tail	Type of wings	Distinguishing marks/behavior	Area found

Birds and Their Adaptations

Bird Data Sheet

Name	Type of bill	Type of tail	Type of wings	Distinguishing marks/behavior	Area found

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Creative Writing in the Outdoors

UNIT CONCEPTS

- The natural environment provides a stimulus and inspiration for creative writing.
- Each individual has a different perception of and emotional response to the natural environment.

OBJECTIVES

- Write and share four adjectives that describe something in the natural environment.
- Write and share three nouns which name something in the natural environment.
- Write and share three verbs that describe what something is doing in the natural environment.
- Write and share a cinquain.
- Write and share a senses poem.
- Write a description of their reaction to the experience of sitting quietly in the forest using any literary form they wish.

MATERIALS

paper
pencil
lapboard

MAJOR CONCEPTS

Environmental Awareness

GRADE

4 - 6

TIME

1.5 to 2 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Read with the students poetry and prose by authors such as Walt Whitman, Robert Frost, Emily Dickinson, John Muir, Henry David Thoreau, who have been inspired by the natural world. What kinds of ideas do they express? How do they feel about the environment? What kinds of things do they write about? How do you feel when you are in the natural environment?

Field Activity

1 Many people visit a forest area but they never find out what it really is like. Why do you think they don't find out what the forest is like? What do you think a person has to do to find out about the forest? You must be quiet and let the forest come to you. You must watch, listen, smell and feel the forest to experience it. Have you ever sat quietly in the forest for 10, 20 minutes or longer at a time? What things happened if you did? How did you feel? Have you ever tried to write down your experiences and feelings about the environment?

2 Many people in the past have. They sat in the forest and watched . . . and wrote about what they saw and heard. Read to the students *A Bird Came Down the Walk.* What was the bird doing? What was the person doing? What happened when the person moved? What does that tell us if we want to experience the forest? Read quote from John Muir. How did this person feel about the woods?

3 Today you will write about the forest and how you feel about it just like these people did. First find an object you really like or that really interests you. Then write four adjectives that describe your object. What is an adjective? (Have students find their objects, write their adjectives, and when they are done have them regroup at a specific spot.) Have the students read their adjectives and have the other students guess their objects.

4 Move further on the trail. Read or have one of the students read one of the poems on the cards. Have the students find new objects. This time have them write three nouns to name each object. What is a noun? (Have students find an object, write their nouns, and when they are done have them regroup at a specific spot.) Have students read the nouns and tell why they gave the object the different names.

5 Move along further on the trail. Again read or have one of the students read one of the poems from the cards. Again have the students find something interesting and have them write three verbs to describe what their objects are doing. Repeat the procedure from steps 3 and 4. Have the students name their objects and read the verbs which tell what the objects are doing.

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6 Move a little further along the trail. Read or have a student read an example of a cinquain. The poem you just heard is a cinquain.The cinquain has five lines: the first line is one word and is a noun which names what you are writing about; the second line is two words which are adjectives that describe what you are talking about; the third line is three words which are verbs that tell what your subject is doing; the fourth line is four words which tell how you feel about it; the fifth line is one word which is a noun which means the same as the noun in line one. Have the students find something about which they want to write a cinquain. When they are done have them regroup. Have students volunteer to read their cinquains. Can the other students guess what they are writing about?

7 Have the students move to a new area. Read or have a student read an example of a senses poem. The poem you just listened to is a senses poem. Why do you think it is called a senses poem? A senses poem is five lines: line one is one word which describes the color of the subject; line two is two words which describe how the object feels; line three is three words which describe what you hear or might hear from the subject; line four is two words which describe how the subject smells; line five is one word which describes how the subject tastes. Have each student find a subject and write a senses poem about it. When the students are done have them regroup and share their senses poems. Can the other students guess the subject?

8 Lastly, have each student find a magic spot, a place to be alone to experience the forest. Students should locate their magic spots away from other students and they should be quiet for the 10-20 minutes that they are at their magic spots. Tell them to get comfortable by sitting against a stump or tree. They should write, in any way they would like, what they observe and feel while they are at their magic spots. The students will regroup by your prearranged signal. Students may volunteer to read their prose or poetry at the end of the magic spot. (Be sure the students take all their writings with them. You may want to have them put their names on them, collect them and give them to their teacher.)

Follow-Up Activity

Have the students visit the school neighborhood. Have them write poetry about the things they experience in this environment. How do they feel about the human environment versus the natural environment?

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NOTHING GOLD CAN STAY

Nature's first green is gold,
Her hardest hue to hold.
Her early leaf's a flower;
But only so an hour.
Then leaf subsides to leaf.
So Eden sank to grief,
So dawn goes down to day.
Nothing gold can stay.
Robert Frost

Come to the woods, for here is rest. There is no repose like that of the green deep woods. Here grow the wallflower and the violet. The squirrel will come and sit upon your knee, the logcock will wake you in the morning. Sleep in forgetfulness of all ill. Of all the upness accessible to mortals, there is no upness comparable to the mountains.
John Muir

Creative Writing in the Outdoors

A Bird Came down the Walk

A Bird came down the Walk—
He did not know I saw—
He bit an Angleworm in halves
And ate the fellow, raw,

And then he drank a Dew
From a convenient Grass—
And then hopped sidewise to the Wall
To let a Beetle pass—

He glanced with rapid eyes
That hurried all around—
They looked like frightened Beads, I thought—
He stirred his Velvet Head

Like one in danger, Cautious,
I offered him a Crumb
And he unrolled his feathers
And rowed him softer home—

Than Oars divide the Ocean,
Too silver for a seam—
Or Butterflies, off Banks of Noon
Leap, plashless as they swim.
Emily Dickinson

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Creative Writing in the Outdoors

To the Grasshopper and the Cricket

Green little vaulter in the sunny grass,
Catching your heart up at the feel of June,
Sole voice that's heard amidst the lazy noon,
When even the bees lag at the summoning brass;—
And you, warm little housekeeper, who class
With those who think the candles come too soon,
Loving the fire, and with your tricksome tune
Nick the glad silent moments as they pass;—
Oh, sweet and tiny cousins, that belong,
One to the fields, the other to the hearth,
Both have your sunshine; both, though small, are strong
At your clear hearts; and both were sent on earth
To sing in thoughtful ears this natural song—
In doors and out,—summer and winter,—Mirth. *(1817)*
Leigh Hunt

Creative Writing in the Outdoors

The Peace of Wild Things

When despair for the world grows in me
and I wake in the night at the least sound
in fear of what my life and my children's lives may be,
I go and lie down where the wood drake
rests in his beauty on the water, and the great heron feeds.
I come into the peace of wild things
who do not tax their lives with forethought
of grief. I come into the presence of still water.
And I feel above me the day-blind stars
waiting with their light. For a time
I rest in the grace of the world, and am free.
Wendell Berry

A PASSING GLIMPSE

To Ridgely Torrence
on last looking into
his "Hesperides"

I often see flowers from a passing car
That are gone before I can tell what they are.

I want to get off the train and go back
To see what they were beside the track.

I name all the flowers I am sure they weren't:
Not fireweed loving where woods have burnt—

Not bluebells gracing a tunnel mouth—
Not lupine living on sand and drouth.

Was something brushed across my mind
That no one on earth will ever find?

Heaven gives its glimpses only to those
Not in position to look too close.
Robert Frost

A noiseless patient spider,
I marked where on a little promontory it stood isolated,
Marked how to explore the vacant vast surrounding,
It launched forth filament, filament, filament out of itself,
Ever unreeling them, ever tirelessly speeding them.

And you O my soul where you stand,
Surrounded, detached, in measureless oceans of space,
Ceaselessly musing, venturing, throwing, seeking the spheres to connect them,
Till the bridge you will need be formed, till the ductile anchor hold,
Till the gossamer thread you fling catch somewhere,
O my soul. *(1863)*
Walt Whitman

THE OVEN BIRD

There is a singer everyone has heard,
Loud, a mid-summer and a mid-wood bird,
Who makes the solid tree trunks sound again.
He says that leaves are old and that for flowers
Mid-summer is to spring as one to ten.
He says the early petal-fall is past,
When pear and cherry bloom went down in showers
On sunny days a moment overcast;
And comes that other fall we name the fall.
He says the highway dust is over all.
The bird would cease and be as other birds
But that he knows in singing not to sing.
The question that he frames in all but words
Is what to make of a diminished thing.
Robert Frost

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Exploring Freshwater Communities

UNIT CONCEPTS

- Certain physical characteristics define a pond and/or stream.
- Plants and animals that can meet their needs for life are found in a stream/pond.
- Plants and animals with the same problems for meeting their needs for life may have different ways (adaptations) to solve their problems.
- There is a diversity of living things found in a stream/pond.
- Plants and animals that live and interact together live in a community.
- Energy is passed from one living thing to the next in a stream/pond community.
- Everything in a stream/pond community is interrelated. When one thing is affected by people or natural processes, other parts of the community are also affected.

OBJECTIVES

- Describe two physical characteristics of a stream/pond.
- List five different plants and/or animals found in a stream/pond.
- Describe the way one stream/pond animal meets the following needs: eating, breathing, getting food and protecting itself.
- Construct a food web using three food chains composed of the animals collected.
- Define community, producer, consumer, herbivore, carnivore, decomposer.
- Construct a food chain in a stream/pond community.
- List three possible ways that people or nature could change the stream/pond community.

MATERIALS

enamel pans
stereomicroscope
thermometer
secchi disc
petri dishes
paper
clipboard
strainers
field guides
clear glass bottle
collecting containers
plastic spoons
pencils

MAJOR CONCEPTS

Community
Adaptations
Interrelationships

GRADE

4 - 6

TIME

1.5 to 2 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

- Study a relief map showing streams, rivers, etc. Discuss where water goes when it rains and introduce the concept of watershed. Trace the watershed that serves your community. See the activity *Investigating the Water Cycle and Watersheds.*
- Have students use their imagination to design fictitious critters that breathe, move, eat and protect themselves with one of the following strategies:
  Breathing strategies: filtering oxygen out of the water, carrying air underwater, going to the surface, sucking air through hollow tubes.
  Moving strategies: using its whole body, jet propulsion, oars, webbed feet, fins, long tail.
  Eating strategies: chewing, sucking, straining, scraping, clamping food with its legs, catching food with a flap.
  Protective strategies: hard shells, camouflage, portable houses.
- The stream/pond is a natural community; the plants and animals live and interact together. What is your human community like? What jobs do people perform in your community?

Field Activity

1 Identifying a stream/pond. **How do you know that a stream/pond is located here?** (The stream/pond may be smelled, cooler air, topography, types of plants growing near the water.) Where does the water come from? What area would be included in this stream's/pond's watershed? Where would the water in a spring come from? (water table collected from precipitation absorbed by earth). Where is the water going? If you could follow it downstream, what would you find? Verbally trace its course through bigger waterways to the ocean and back to land via evaporation and precipitation (water cycle).

What are some of the physical features of a stream/pond?

- Have the students investigate where the stream is flowing the fastest by racing bits of wood or leaves in different parts of the stream. What effect do big rocks, undercut banks, depth and bottom composition have on the flow? Is the flowing water carrying anything in it as it goes downstream? Collect water in a glass jar and let it settle.
- Have students investigate the clarity of water in a pond. How far can they see down into the water? Use a secchi disc. What is the composition of the bottom?
- What is the temperature of the water? Moving water has a higher oxygen content than still water. Observe the bubbles of air in the moving water. Why is the oxygen content of the water important?

2 What kinds of plants and animals might live in a stream/pond? Make a list on a blackboard or paper. What do they need to survive? (food, air, protection) What effect would the physical features of a stream/pond have on the life in it? (fast-moving water, low oxygen)

Using containers and strainers, have students gather specimens in the stream/pond.

- Students should be reminded to stay on the bank and to disturb the surroundings as little as possible (eg. replace stones).
- In the pond, sweep the strainer through the bottom mud and weeds, being sure to avoid rocks.
- In the stream, when collecting animals from under stones in fast currents, place strainer downstream of the stone, and lift stone up on the side closest to the strainer. Remove animals from strainer to the container.

Place specimens in the enamel pans. Use field guides and *A Guide to Common Freshwater Animals* to help identify specimens.

3 What physical features do the specimens found have for surviving? Using specific specimens, try to discover how they move (oars, hairs, jet propulsion, fins, tails); breathe (tubes, gills, air bubbles under wings); gather food (flaps, strong clamps, sucking mouthparts); and protect themselves (camouflage, protective coverings). Using the microscope, try to deduce what type of food each specimen would eat from observing its food gathering aparatus. Be sure students understand how to use the stereomicroscopes.

4 Count the number of different types of living things found from collecting. (The diversity of organisms in an area is an indicator of the health of that area.)

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5 Plants and animals live and interact together in a stream/pond. They live in a **community**. Each living thing in a stream/pond has one or more jobs. What do green plants do? (They are **producers** that make, or produce, food energy from the sun.) How many examples of producers can you see? Animals can't make their own food; they are **consumers** of food energy. What are animals that eat plants called? (Herbivores eat only plants.) What are animals that eat other animals called? (Carnivores are meat-eaters.) What are animals that eat decaying things called? (**Decomposers** recycle dead plants and animals.) Can you find examples of consumers that are herbivores, carnivores and decomposers?

6 A simple way to describe the path that energy takes as it is passed from one living thing to the next is called a **food chain.** Food energy is made by the green plants and passed on to a herbivore and then passed to a carnivore. Ask the students to give an example of a food chain in a stream/pond community.

7 In the natural environment energy transfer is more complex and has more interconnections. It is called a **food web.** Have students connect three food chains composed of the animals collected. Discuss what would happen if one or two of the animals were eliminated from the food web.

All living things interact with other things in their surroundings and depend on one another to maintain conditions that are best for their survival. What are the physical characteristics that plants and animals have adapted to in their stream/pond community? (temperature, oxygen, current, velocity, sediments and chemicals in the water) What ways could we change these conditions? How would this affect the living things in the stream/pond?

8 Based on the information you have collected, do you think this is clean or dirty water? Why? If the water has few animals or many animals or just two or three kinds, it has or is experiencing some form of pollution. If the water has a large number of different animals, the water quality is good.

Follow-Up Activity

- Food Web Game. Using members of the stream/pond community and other natural communities, make a food web showing the interdependence among stream/pond and other life forms. To play the game, put the name of various natural community members on 3 x 5-inch cards; include a card for a human being and the sun. Give each student a card. Have the person with sun card stand in middle of an open area and have the remainder of the class form a circle around the sun. Each student should hold his/her card so that everyone else may see it. Give the sun a roll of kite string. To begin, the sun passes the string to a community member who can capture the energy from the sun. The string is then passed to something that eats or is eaten by whomever has the string. Continue to pass the string until all connections are made. The string should only be passed between any two life forms once. A web should form showing the interdependence between all community members.

- Have the students make a mural depicting a typical stream and emphasizing physical features and the community within the stream.

- Have the students investigate a stream or pond near the school at least once every three months. What changes occur through the seasons? Is the water quality good or poor? Have students chart the results and make a report to the rest of the school, PTA, or local community group.

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Exploring Habitats

UNIT CONCEPTS

- Animals and plants need food, water, cover and air to live.
- A habitat is a place where a plant or animal lives.
- A niche is a role or job a plant or animal performs.
- A community is a group of plants and animals living, meeting their needs and interacting with each other in a specified area.
- When one organism eats or decomposes another, a one-way transfer of energy in the form of food occurs.
- As energy is transferred, 90 percent of the useful energy becomes unavailable for the next consumer.

OBJECTIVES

- List four requirements for life: food, water, shelter, air.
- Define habitat and list the components of a habitat.
- Define niche and give example of niches for three members of the area.
- Define community and describe two examples of interrelationships occurring in the community.
- Create a food chain and web using members of the community.
- Build a food pyramid and explain how it is arranged.

MATERIALS

lapboard
thermometers
trowels
3x5" cards
soil pH kit (optional)
10-foot strings or poles
data sheets
anemometer
kite string

MAJOR CONCEPTS

Community
Energy Flow
Interrelationships

GRADE

5-6

TIME

1.5 to 2 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Define what a human community is and how it is arranged. Describe jobs that members of the community perform to serve the community. Do their jobs fulfill our needs for life?

Field Activity

1 Select a general area to study. What kinds of plants make up this area? (Describe in terms of height, density, woodiness vs. herbaceousness.) What animals would you expect to live here? What do animals need to survive? (food, water, shelter or cover, air.)

2 Break your group into small groups of three to four students. Pass out data sheets and equipment. Explain the procedure. What do you call the place where a plant or animal lives? (habitat) For example both a deer and a mouse might live in this habitat but different characteristics are important for each animal's needs. What do you think is important about this habitat for a deer's needs? (trees for cover, green plants, etc.) For a mouse's needs? (grass for cover and seeds on ground, etc.)

Have each group survey a different area such as the coniferous forest, deciduous forest, dense or sparse vegetation areas, or areas with special features such as a nearby tree, water, etc. Disperse the group for 20-30 minutes for survey. Each group should set up a 10x10-foot plot by pacing or using a string. Use available stones and sticks for corner markers.

3 Regroup to discuss results. Where is it warmest: at 3 feet, ground level, or in the ground? Where is it windiest? Where is a good place for protection from temperature and winds for a large animal, small animals or plant? Was the soil easy to dig into? (ie. would it be difficult for an animal to burrow? Did you find many holes in the ground?) What color was the top layer of soil? The next layer? Which layer do you think holds the most organic material or nutrients? (top) Why? Was this layer very deep? How might this affect plant growth ? What does pH mean? (how acid or alkaline the soil is) Why is this important? Only certain plants can live at extreme ends of a pH scale. Would your pH reading show the soil had limited the types of plants that can grow in your area? Are there any other non-living factors that affect the community? (light and water) How might the amount of light affect the plants and animals living there? What were the most common plants in your area? Animals use plants for cover and food. Looking at your map, could an animal, large or small, cross your area to go towards water or food and still remain undetected? Why?

4 What signs did you find of animals in your area? Did anyone see an animal? Plants and animals have jobs they perform; does anyone know what the special term for a job or role is? (a niche) What are some of the animals and plants you listed? What are their niches? Have students fill in #1 on their data sheets. This information will be used later for a food web. Can you find any examples of one plant or animal whose job may help another plant or animal? Where you live, lots of people have jobs. Do those people help you? How? (waste disposal workers, home repairers, etc.) What do you call a group of people living and working together? (a community) What is each person in that community called? (a member) What do you think a group of plants and animals living and interacting with each other is called? (a community) And what is each plant or animal called in that community? (a member)

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5 Of the jobs or niches listed, which jobs or niches does it seem every plant or animal has? (food for another) Why do plants and animals need food? (energy) Where do plants get their energy? (the sun) Can any other members of this community make their own food from the sun? (no) (Optional — Do you know what it is called when plants make their own food from the sun's energy? (photosynthesis) Since plants are the only ones that make food, what are they called? (producers) Where do animals get their energy? (plants, animals, dead things) Animals that eat or consume food are called? (consumers) Animals and plants that can't make their own food (like mushrooms) that eat dead things are called? (decomposers)

6 How is energy passed from the sun? (sun, plant, animals, etc.) Illustrate an example. Does anyone know what this is called? (a food chain) In nature, there are often more interactions that go on. An animal may get its food energy from more than one kind of plant or animal. Have the students give examples of where certain plants or animals may get their food energy using the members of the community you have already listed in #1 on student data sheet. Draw lines from a member to its sources of food energy. What do all these lines resemble? (a web) Energy is passed in many food chains that are all interconnected. It forms a web. What happens if you touch part of a spider's web? (the rest of the web moves) This is similar to a food web. What would happen if you removed certain members of a community such as plants, animal eaters, plant eaters, decomposers? (It would affect the whole web)

7 In the food chain we constructed do you think there is an equal amount of energy (food) available for each member of the food chain? (no) What evidence is there that tells us there is more energy available for plants and some animals than for other animals? (there are more of them) What happens to energy as it is transferred from the sun to plants to plant-eaters to meat-eaters to decomposers? (energy is lost as heat through respiration and reproduction) At each link in the food chain, 90 percent of the energy is lost and only 10 percent is available as food for the next link in the food chain. If this is true would you expect there to be more rabbits or weasels? More weasels or hawks? Using the amount of energy available to them, arrange a food chain with the link with the most members at the bottom and the link with the least members at the top. The resulting diagram illustrates a food pyramid, with the greatest number of individuals at the bottom and the fewest individuals at the top.

Hawks
Weasels
Shrews
Grasshoppers
Plants

Follow-Up Activity

Survey your school yard as a community. What plants and animals did you find there? How well are their life's needs fulfilled? What can you do to encourage or discourage certain members of the community to live there?

To encourage: Plant more plants that are good cover and food sources; make bird feeders, houses or baths; stake off existing plants to protect them; create a plant nursery; leave a small section unmowed.

To discourage: (such as rats) pick up litter, create more appealing areas for other plants and animals.

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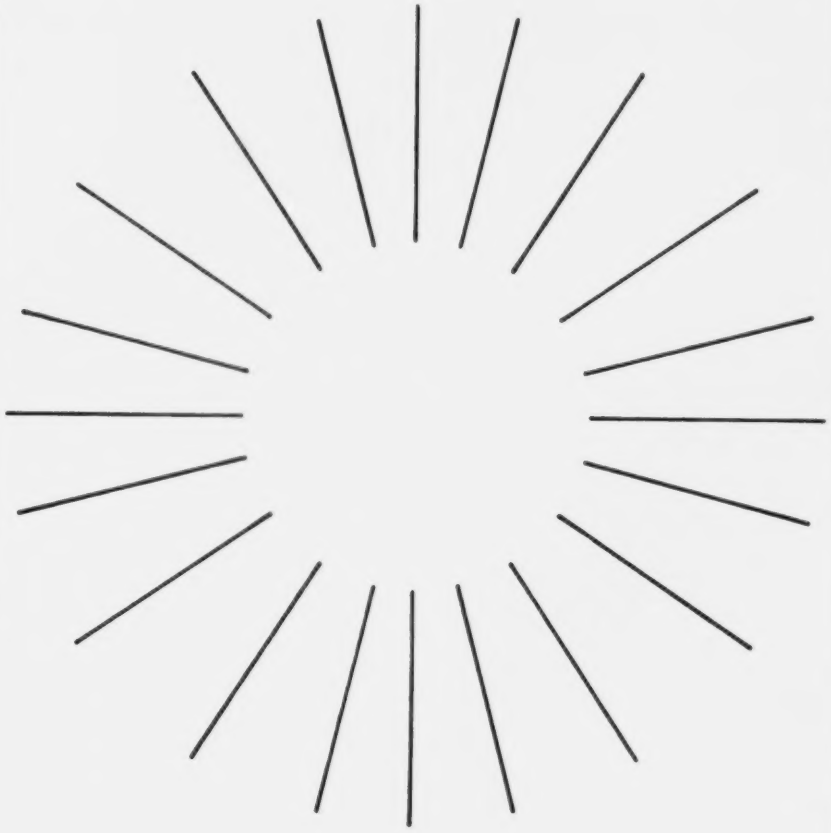
Exploring Habitats

Student Data Sheet

List all the members of the community on the lines. **1**



Habitat _____ **2**

Where is the area you are surveying? (For example, in the base of a hill, near stream, etc.)

_____

Temperature

_____ at 3 feet
_____ at ground level
_____ in the ground

Wind Speed

_____ at 3 feet
_____ at ground level

Soil (circle one)

sandy loamy clayey

Depth of topsoil _____

pH (optional) _____

How much light from the sky hits the study area? (circle one)

brightly lit partially shaded very shaded

3 PLANTS

Sketch leaves from five of the most common plants.

4

List each plant and animal you found in your community. Check off each job that each plant or animal performs in the community.

COMMUNITY MEMBERS	Makes food	Plant-eater	Animal-eater	Eats dead things	Food for other animals	Aerates the soil	Adds oxygen to the air	Adds carbon dioxide to the air
PLANTS								
ANIMALS								

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Exploring Plant Communities

UNIT CONCEPTS

- A plant community is a group of plants living together in an area that meets their special needs for energy and nutrients.
- Plants are broadly classified into two groups—seed-bearing and spore-bearing—which are determined by the plant's means of reproduction.
- Each plant fills a certain role or niche in the community.
- A large number of plants exist to make the best use of available energy and nutrients in the community.

OBJECTIVES

- Define community.
- Identify at least four seed-bearing and four spore-bearing plants.
- State why each of the identified plants was categorized as either seed-bearing or spore-bearing.
- Categorize each plant identified as to the strata it occupies in the community and whether it is a dominant or subordinate plant.
- List at least one job that each plant performs for the community.
- Define diversity and show how diversity is shown in the plant community.

MATERIALS

lapboard
paper
pencil
plant identification books
student data sheets

MAJOR CONCEPTS

Community
Diversity
Interrelationships

GRADE

4 - 6

TIME

1.5 to 2 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Define what a human community is and how it is arranged. Discuss the roles or jobs different people perform in the community. Do these jobs fulfill our needs for life?

Field Activity

1 What basic needs do you have in order to live? (food, shelter, air and water) How do we meet these needs? Do you meet all your needs yourselves? Do you grow your own food? Build your own house? Make your own clothes? Different people perform different jobs for us. In return other people meet their needs by doing jobs for them. What are some examples? Groups of people living near one another and working together to meet their needs form communities. Today we are going to look, not at a human community, but a plant community. What do you think a plant community is? (a group of plants living together in an area to meet basic needs) What needs do plants have? Are they different than ours?

2 Break your group into smaller groups of three to four students. Give each group its equipment and data sheets. Assign each group a specific area of the forest to explore. Review the data sheet with the large group.

- How do we tell the difference among flowers, fruits, seeds and spores? (flowers are the reproductive parts of flowering plants; fruits are seeds with fleshy pulp; seeds are the hard-coated embryo of a flowering plant from which a new plant may grow; spores are the dust-like reproductive mechanism of non-flowering plants)
- Draw a picture of the flower, fruit, seed or the place on the plant the spores come from.
- A woody plant is solid all the way through. A fleshy plant has a soft inside. What does a plant being woody or fleshy tell us?
- What does dominant mean? (Dominant plants determine the growing conditions for other plants. Subordinate plants are those whose growing conditions are set by the dominant plants.)
- The canopy or overstory would be what plants? Understory? Shrubs? Groundcover?
- What kinds of jobs might a plant perform? (provide food for other plants and animals, recycle nutrients for growth, hold the soil in place, provide a place for other plants to grow, add oxygen and carbon dioxide to air, etc.)
- What types of plants may we expect to find? (trees, shrubs, herbaceous (non-woody), lichens, mosses, fungi, algae, ferns, club mosses)
- How many of this type are located in your area?

3 Assign each group a 10-foot by 10-foot area to investigate. Have the students investigate and fill out the data sheet for as many plants as they can in the allotted time. Circulate among the groups to monitor their progress and offer help and encouragement when needed.

4 Form a sharing circle to discuss the results of their investigation. First count how many plants you found at each layer in the plant community: canopy ____, understory ____, shrubs ____, groundcover and herbaceous ____. What happens with the number of plants as we go from the ground to the canopy? Keeping in mind what the needs of plants are, do you think all plants need the same amount of air, light, water, food and shelter? Which plants do you think need the most light, the least light? Which plants need the most water, the least water? What aspect of a plant tells you how much water it needs? Are the plants that require the most of everything the dominant or subordinate plants? Which plants are the subordinate plants? Why?

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5 We also investigated whether plants reproduced by seed or spores. Are there more seed-producing plants or more spore-producing plants? What level does each of these types of plants occupy? What advantages do seed-producing plants have? What disadvantages do they have? How about the spore-producing plants? What advantages do they have? What disadvantages?

6 The plants here are busy doing a lot of jobs. What are some of the jobs that each type of plant does? Trees? Shrubs? Herbaceous? Lichens? Mosses? Fungi? Ferns? Algae?

Are there special jobs that only certain types of plants can do? (green plants (producers) make their own food; lichens (pioneer plants) can dissolve minerals from rocks; fungi (decomposers) can recycle dead plant material)

7 Do you think that the members of our plant community are dependent on or independent of one another? What would happen if the fungi disappeared? Or lichens all died? The plants in this community are interdependent; they need one another.

8 Did we find a large number of plants today or a small number of plants? Why? (Different plants have different needs, and they are all able to meet those needs in the community.) What are some examples of different plants meeting their different or special needs? You've just discovered what diversity is. Who thinks they know what we mean when we say a community shows diversity? (A large number of plants exist to make best use of available energy and nutrients.)

9 Are there just plants in our community? (The plant community is just part of the ecological community which includes animals and nonliving things. All these community members are also interdependent on one another.)

Follow-Up Activity

Explore the plant community of the schoolyard and surrounding neighborhood. How is it the same and how is it different from the plant community investigated earlier? Why do you think it is different?

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Exploring Plant Communities

Student Data Sheet

Please investigate the plant community and record the necessary information for the plants you find in your area. Ask your leader if you need any help.

Check one					Draw a picture of the flower, fruit, seeds, or spores	Check one		Check one			Check one					Jobs it performs for the community	Type of plant	Number
Flowers	Fruits	Seeds	Spores			Woody	Fleshy	Dominant	Subordinate		Canopy	Understory	Shrub	Groundcover				

Exploring the Soil

UNIT CONCEPTS

- Soil is a mixture of nonliving materials (inorganic materials) and once-living materials (organic materials).
- There is a finite amount of building materials for life on earth, and they must be used over and over again.
- The interactions between the decomposers and living and nonliving materials of the soil influence the quality of the soil and all plants and animals living from it.
- Qualities of the soil can be measured, such as number and presence of decomposers, permeability rate, temperature, color, texture, layers, pH and erosion potential.
- Soil qualities can be interpreted to determine their effects on plants.
- People must consider many factors when planning for land use.

OBJECTIVES

- List and describe the components of the soil.
- Describe how nutrients are recycled in the soil cycle.
- Identify three decomposers and describe one way they affect the soil and one way the soil affects them.
- Observe and record qualities of the soil including number and presence of decomposers, permeability rate, color, texture, layers, pH and erosion potential.
- Determine the relationship of soil qualities and the plants found in this area using data tables.
- Give two examples of human land use, and determine their strengths and weaknesses.

MATERIALS

For each group:

trowel
soil thermometer
pH test kit
50- or 100-inch stick
open-ended tin can
stereomicroscope (optional)
yard stick
level
water bottle
watch
soil auger

For each student:

pencil
lapboard
data sheet
hand lens

MAJOR CONCEPTS

Cycles
Interrelationships
Community

GRADE

5 - 6

TIME

2 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Ask the students what elements make up soil. Have them make their own soil by pulverizing soft rock, such as shale, with a geology hammer and adding whatever else they think soil contains. (You may want to break the rock up for them; be sure to take proper safety precautions.) Have them plant seeds in the soil they made and in soil from a garden or other open area. Did all the seeds grow? Which did and which did not?

Field Activity

1 Of what is soil made? In a large group, scoop out one trowel full of soil and spread it around an enamel pan. Have students describe what they find in the soil.

2 Why is soil important? How does it help the plants? (support, water, nutrients) Do you think some soil helps plants more than others? How? (more nutrients, better water supply, easier place to grow) Do plants take anything from the soil? (water, nutrients) Is there an endless supply of nutrients? How are more nutrients put back in the soil? (decomposers, weathering, fertilizers)

3 What plants and animals help make more nutrients available to the soil? (certain insects, worms, snails, protozoa, bacteria, fungi, actinomycetes) Put any animals found in a container and pass them around. Set up a stereoscope for smaller animals. Can you find any here? Do you think these living organisms have an effect on the characteristics of the soil? (yes—more nutrients available, aerators) Do you think the characteristics of the soil have an effect on the number of organisms in the soil? (amount of organic material, moisture, compactness of soil, pH, etc.)

4 Before breaking the students into small groups, explain that they will examine qualities of the soil to determine what influence it has on the natural community. Distribute equipment and data sheets. Describe how to use any equipment with which they may have problems. Emphasize the use of hand lenses or stereoscope.

Permeability test—Clear area and push can into the ground one to two inches. Pour one cup of water into the can and count the seconds it takes for the water to soak into the ground.
pH—Follow kit directions.
Slope—See instructions on data sheets.

Soil thermometers should be carefully and slowly pushed into the ground while holding the stem. Never push the thermometer into the soil while holding the dial or if you feel solid resistance. Find another spot to take the soil temperature rather than force the thermometer into the ground. You need only push the thermometer into the ground to the notch on the stem.

Try and locate student groups in areas of different soil characteristics. This will aid in conducting the discussion portion of the activity.

5 Bring the group back together to discuss and analyze the data. Refer to the Soil Data Charts to analyze the group's findings.
Permeability
What were your rates? What do you think could have influenced the permeability rate? (amount of rain, compaction, size and texture of particles) Was your area heavily travelled by people? Is it important that the water drains quickly? Why? (yes; so it doesn't suffocate living things) Is it important that soil holds water? Why? (yes; so the roots can get it) Which type of soil do you feel would have both these qualities? Compare results. Was much litter and duff present? Why?
Color
Topsoil. Look at the *Toposil Color Data Chart.* What does the color tell you about the amount of organic matter, erosion qualities, aeration (amount of air) and fertility? How does this relate to the permeability? (erosive qualities and aeration)
Subsoil. Look at *Subsurface Soil Color Data Chart.* What is the drainage of the subsoil according to the color? How would this influence plant roots?

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Texture
What was the texture of the soil? As discussed, it has to have a combination of qualities. What are they? (water-holding capacity and good drainage to allow space for air) Check the table to see the qualities your soil has.

Temperature
Plant growth is affected by temperature. What is your soil temperature? Look at the *Soil Temperature and Plant Growth Chart.* What is the growth rate for the season? What do you think the growth rate will be in three months?

pH
On the basis of soil pH, what plant species could live here? What characteristics may influence pH? (pine needles, rocks and minerals, acid rain)

Slope
What did the color of your topsoil say about the erosion factor in your soil? How does this compare to the erosion quality when considering slope percent?

6 Compare the kinds of plants found in the area to the list of plants on the *Soil pH and Plant Species Chart.* Why are they different? (the pH and plants listed are optimum pH for those plants) Is there any evidence that tells us whether this is the best pH for each plant species present? If not, how could we find out?

7 What kinds of animals did you find in the soil? How are these animals adapted to live in the soil? List each animal and how it helps the soil on the *Student Data Sheet.*

8 Do you think this is good soil? Do you think it could be used for other purposes than for what it is being used now? Is there any evidence that the soil is being used improperly or once was used improperly?

What are some ways people use soil? Could we use this soil that way? What would happen if we did? Are there any ways we could improve this soil? Why is it important to manage the soil?

Follow-Up Activity

- Continue observations of seeds planted in different soils as part of lead-up activity. In which soils did the beans grow? What do the students think is needed in the soil that did not grow plants?
- Visit a construction site. Is there any erosion? Is anything being done to protect the land against erosion? Is any of the soil being saved? For what was the area formerly used?
- Are there signs of erosion on the school ground? Can anything be done to protect the soil there?
- Have a land use planner visit the class to talk about how land use and soils are related.

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Exploring the Soil

Soil Data Charts

Topsoil Color Data Chart

Condition	Color		
	Dark—*dark grey brown to black*	**Moderately Dark**—*brown to yellow brown*	**Light**—*pale brown to yellow*
Amount of organic matter	high	medium	low
Erosion	low	medium	high
Aeration	high	medium	low
Fertility	high	medium	low

Soil pH and Plant Species

Plants may be classified by their preference for certain pHs. They may be divided roughly into three groups: Group A—neutral, pH 6.0-8.0; Group B—slightly acid, pH 5.0-6.0; GroupC—acid-loving, pH 4.0-5.0. This information is from the *LaMotte Soil Handbook.*

Group A
dilanthus, ash, aster, barberry, beech, bluets, coltsfolt, daffodil, dandelion, day lily, devil's-walking-stick, dogwood, Christmas fern, goldenrod, honeysuckle, maple, tulip tree, privet, sassafras, sumac, white oak, willow, violet, trout lily.

Group B
apple, azalea, bloodroot, chicory, chestnut oak, ground pine, holly, Indian pipe, jack-in-the-pulpit, mountain laurel, red oak, rhododendron, spruce, ginger, wintergreen.

Group C
trailing arbutus, pink lady's-slipper, scrub oak, pitcher plant, sundew.

pH Scale

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Soil conditions < 4.5 are not favorable for most plants

Most plants do best here

Above 8.5 too alkaline for most plants

Relationships of Slope % to Erosion Hazard

Slope %	Erosion Hazards
0-3	None to slight
3-20	Slight to moderate
20-30	Severe
30-40	Very severe

Some Effects of Texture on Soil Conditions

Texture	Water-Holding Capacity	Looseness of Soil
Sandy	Poor	Good
Loamy	Good to excellent	Good
Clayey	High—*water held too tightly for plant use*	Poor

Soil Temperature and Plant Growth

Soil Temperature	Plant Growth During Growing Season
< 40°F (4°C)	No growth, soil bacteria and fungi not very active
40°-65°F (4-18°C)	Some growth
65°-70°F (18-21°C)	Fastest growth
70°-85°F (21-29°C)	Some growth
Above 85°F (29°C)	No growth

Subsurface Soil Color Data Chart

Subsurface Soil Color	Condition
dull grey—*if in low rainfall soils 0-20"*	water-logged soils, poor aeration
yellow, red brown, black—*if in forest soils*	well-drained soils
mottled grey—*if in humid soils*	somewhat poorly to poorly-drained soils

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Exploring the Soil
Student Data Sheet

Permeability

1 It took _____ seconds for one cup of water to soak into the ground. What do you think could have influenced the rate the water soaked in? _____

_____

2 Layers, Color, Texture, Temperature, pH

Layers Above Topsoil—*if existing*
Litter Layer—*top layer including leaves*
Depth _____ inches
Description _____
_____
How does it feel and smell? _____
_____

Duff—*partially decomposed organic matter compacted together*
Depth _____ inches
Description _____
_____
How does it feel and smell? _____
_____

Temperature
_____ at 3 feet
_____ at ground
_____ in ground

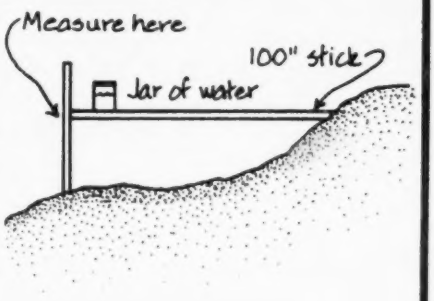
Topsoil—*Use soil auger or dig a hole*
Depth _____ inches
Color _____
Texture—*How does it feel?*
____ gritty—*not plastic*
____ smooth & slick—*not gritty or sticky*
____ sticky—*smooth and plastic*
Temperature _____
Plant roots visible? yes no
pH _____

Soil pH is an indication of how well certain plants can grow in the soil. Use a small sample. Touch as little as possible.

Subsoil
Depth _____ inches
Color _____
Texture—*How does it feel?*
____ gritty
____ smooth & slick
____ sticky
Temperature _____
Plant roots visible? yes no
pH _____

Slope

3 Select a place that represents the average slope of the land being studied. Place one end of a 100-inch stick on the slope you want to measure (or use a 50-inch stick, but remember to multiply your result by 2). Hold stick outright to be about level. Place a level or jar with liquid on the outright stick. Raise or lower the stick until level. Measure the number of inches the free end of the stick is off the ground. The number of inches is the slope of the land in percent. How do you think slope affects the soil and plants and animals living in the community?



4 Make a list of the plants found in your area. Compare your list to the list of plants for the pH of the soil you have. Are they the same? Why do you think they are different?

5 Make a list of the animals found in your soil. How does each animal help the soil?

Animal	How It Helps the Soil

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How Many Animals Live Here?

UNIT CONCEPTS

- A population is a group of organisms of the same kind that live and reproduce in a particular area.
- The capture, mark, release and recapture population estimate method is a reliable method to estimate animal populations which are difficult or impossible to count.
- One aspect of wildlife management is the ability to estimate wildlife populations in order to effectively manage a specific species.

OBJECTIVES

- Estimate the population of grasshoppers in a given area using the capture, mark, release and re-capture population estimate method.
- State three reasons why estimating animal populations is of importance in wildlife management.

MATERIALS

colored nail polish
sweep nets
paper
pencil
lapboard

MAJOR CONCEPTS

Problem Solving

GRADE

5 - 12

TIME

1.5 to 2 hours

SEASONS

Summer

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Lead-Up Activity

Do the OBIS activity *Bean Bugs*. This activity introduces the students to another population estimate technique: the quadrat method.

Field Activity

1 What is a population? A population is a group of organisms of the same kind that live and reproduce in a particular area. Can you give an example of a population? Are there human populations? Give me an example. How do we find what the human population of a town, city or state is? Each person is counted. What other populations could you find by counting?

2 Can you find the population of any group by counting? How about rabbits, trout, or grasshoppers? How can we find the population of these animals in an area? You can use a quadrat method where you count all the animals in a small area, then multiply that number by a number which would approximate the total area. This would give you an estimate of the number of animals in that area. Or you can capture a certain number of animals, mark them, release them, and capture the same number of animals again. Using the number of recaptured animals versus the number of new animals you can estimate the population.

3 We are going to use the second method to estimate how many grasshoppers live in a certain field. (Limit the students to a certain area to catch grasshoppers.) How many do you think live here? Here is what we are going to do. First we have to capture 50 grasshoppers. We will do that with the sweep nets and our hands. Be careful not to hurt the grasshoppers. Some of you will be catchers and some of you markers. When a catcher catches a grasshopper, let a marker know. The marker puts a dab of nail polish on the grasshopper's thorax and releases the grasshopper in the same spot it was caught. S/he also records on paper how many grasshoppers are marked. The facilitator should keep track of how many grasshoppers have been marked.

4 After at least 50 grasshoppers (or an appropriate number based on the availability of grasshoppers) have been captured, marked and released, wait half an hour to an hour. This may be your lunch break or you may want to do another population-related activity.

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5 Return to the same area. This time everyone is a catcher. All grasshoppers should be brought to one person: the recorder. The recorder lists marked and unmarked grasshoppers until the same number of grasshoppers has been caught as before. The population may now be estimated using the following formula.

$$P = A \times \frac{B}{R}$$

P = population
A = number caught and marked first time
B = number caught second time
R = number caught second time which were marked

Example
A = 50
B = 50
R = 4

$$P = A \times \frac{B}{R}$$

$$P = 50 \times \frac{50}{4}$$

$$P = \frac{2500}{4}$$

$$P = 625$$

There are 625 grasshoppers in the field.

6 Why would we want to know how many animals make up a certain population? (There may be too many, so we might take steps to decrease the population, or too few so we might take steps to increase a population; may be a forewarning of environmental problems; population may be stable and we may want to keep it that way.)

7 What could we do to decrease a population? (make a habitat less desirable, lessen chances of reproduction, directly reduce population)

What could we do to increase a population? (provide more suitable habitat, place animals in unoccupied suitable habitat, offer animals protection)

Follow-Up Activity

- The capture, mark, release and recapture method may be used to estimate the population of other organisms in a given area if the following conditions are met:

A. The marked animals are not affected by being marked and the marks will not be lost.
B. The marked animals become completely mixed in the population.
C. The population is sampled randomly with respect to those being marked.
D. Sampling must be at discreet time intervals and the actual time involved in taking the samples must be small in relation to the total population time.
E. The population is a closed one; there is no immigration or emigration.
F. There are no deaths in the sampling period.
G. Being captured one or more times does not affect an animal's subsequent chance of capture.

Estimate the population of an abundant animal near the school. Compare results of quadrat and catch-mark-release methods.

- Have a wildlife biologist, entomologist, or other scientist visit the class and discuss how population estimates are made and used in their professions.
- Use your population estimates to predict what will happen to the population. Repeat study in succeeding years to prove or disprove predictions. What may account for the population changes?

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Investigating Insects

UNIT CONCEPTS

- The body parts of an insect typically consist of antennae, head, thorax, abdomen, six legs, exoskeleton, and wings.
- Insects undergo a life cycle of complete metamorphosis (egg, larva, pupa, adult) or incomplete metamorphosis (egg, nymph, adult).
- An adaptation is a physical feature that improves a plant's or animal's chances of surviving and reproducing.
- Insects have evolved a large number of adaptations which help ensure their survival.
- Insects are an integral part of terrestrial ecosystems.

OBJECTIVES

- List the major body parts of insects and describe the function of each body part.
- State the life stages in complete and incomplete metamorphosis and two advantages of each life cycle.
- Find one example of an insect in one of the life stages in complete and incomplete metamorphosis.
- Describe three interactions between plants and insects.
- Define adaptation.
- For a field habitat, capture at least two insects and describe at least three adaptations each has.
- For a forest habitat, capture at least two insects and describe at least three adaptations each has.
- List three ways insects help the environment and three ways insects hinder the environment.

MATERIALS

plastic containers
bug boxes
hand lenses
insect field guides
insect data sheet
pencil
lapboards

MAJOR CONCEPTS

Diversity
Interrelationships
Adaptations

GRADE

3 - 6

TIME

1.5 to 2 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Pre-trip discussion of insects should include insect characteristics and life cycles. An investigation of the classroom, school building and school yard should reveal some examples.

Field Activity

1 Today we are going to explore the fields and forests to discover all we can about insects. What are insects? (They have six legs, exoskeleton and three main body parts: head, thorax, abdomen.) Can someone give an example of an insect?

2 To help us learn about insects we are going to fill in an information sheet about insects. Give each student a data sheet, pencil and lapboard. We will fill in the information sheet together for an insect I have here, then you will be able to do it yourself when we get to the area we are going to explore for insects. Let's fill out the data sheet together.

Insect drawing—Draw a picture of your insect(s). Be sure to include head, thorax, abdomen, antennae, wings, tails and to label each part.
Life stage—Who remembers the two life cycles of insects? One is complete metamorphosis, like a butterfly: (1) egg - How big are insect eggs? Where might we find them? (2) larva - is always wormlike; an example is a caterpillar, (3) pupa - resting stage, like a capsule; example is a butterfly cocoon, (4) adult - example is a butterfly. The other is incomplete metamorphosis like a grasshopper: (1) egg, (2) nymph - looks like a miniature adult; example is a grasshopper without wings, (3) adult-example is a flying grasshopper.
Where found—Was it under a log? a tree? in the grass?
What was it doing—Hiding? eating? resting?
Plants and insects—If the insect was on a plant did the insect affect the plant? Was it eating it? Making the plant its home?
Adaptations—What is an adaptation? (An adaptation is any physical feature that helps a plant or animal survive and reproduce.) Does its color help the insect? Wings? Eyes? What kind of mouth does it have? Look over your insect closely to find out what things help it survive.
How adaptation helps—State how each adaptation helps your insect.
Insect's effect on environment—How does the insect affect the environment? What do you think the insect does to or for the environment? Why do you think that?
Insect—To learn more about the insects collected, use the field guide and read the information.

3 Field
Visit a field area. Give each student a plastic container. Have students capture at least two insects and record the required information on data sheets. Form a sharing circle and have students show one of their insects and report the information they found out about their insects.
Forest
Visit a forest area. Repeat the procedure as for the field.

4 Thinking about the life cycles of insects, which life cycle stages enable insects to make it through the winter? How could we find out for sure? What adaptations of insects appear to be the best for their survival? Are there any adaptations that would work against an insect's survival? Did we find a lot of different insects today or were most all the same? How were they different and how were they the same?

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5 How did the insects we found today help plants? How were they bad for plants? How are insects helpful for other animals? How are insects sometimes bad for other animals? When does it seem that insects cause problems (when there are too many of one species) When does this overpopulation occur? (when the ecosystem is upset or altered naturally or by humans)

6 If humans have a problem with insects what can they do about it? Are there problems with the solutions that are proposed? (The concept of interrelationships should be discussed here. If we do something there will be an effect on everything else because all plants and animals interact with one another and their surroundings. Whatever the students propose, the results via food chains and web should be discussed.)

7 Do you think insects are good or bad? (Students should realize that insects are neither good nor bad but become so when human values are applied to them.)

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Forest

1 Draw a picture of your insect

Life stage

Where found

What was it doing?

Adaptations

How adaptation helps

Plants and insects

Effect on environment

2 Draw a picture of your insect

Life stage

Where found

What was it doing?

Adaptations

How adaptation helps

Plants and insects

Effect on environment

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Field

Investigating Insects

Student Data Sheet

1 Draw a picture of your insect

Life stage

Where found

What was it doing?

Adaptations

How adaptation helps

Plants and insects

Effect on environment

2 Draw a picture of your insect

Life stage

Where found

What was it doing?

Adaptations

How adaptation helps

Plants and insects

Effect on environment

Investigating Shapes and Patterns

UNIT CONCEPTS

- Objects come in different numerical arrangements.
- Objects come in different shapes.
- Objects come in different textures.
- Objects come in different patterns.
- Objects are distinguished and identified by noting their similarities and differences.

OBJECTIVES

- Find two examples of objects with a numerical pattern.
- Define and locate three different shapes in nature.
- Identify four textures by touch.
- Define and find one example of a pattern in nature.
- Compare similar objects and note two similarities and differences in the objects.

MATERIALS

picture of shapes
-circle
-square
-triangle
-rectangle
stop sign

MAJOR CONCEPTS

Environmental Awareness

GRADE

K–3

TIME

1 to 1.5 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

Sensory walk. Take a short walk with students emphasizing the use of their senses to become more aware of their surroundings. This will provide a good background for this activity.

Field Activity

1 Today we are going to explore the forest. To help us explore we are going to use our senses. What are our senses? How many do we have? Review the five senses with the students. Have them locate which part of the body is used for which sense and what each sense helps us do. Caution them that they will not be doing any tasting and why.

2 Does everyone know what this sign is? (stop sign) What does a stop sign mean? As we go through the forest and I put up this sign, what do you think we should do? When I put up the stop sign we are going to stop and discover something new. Let's go!

3 Stop sign! Ask younger students to count with their fingers. Many things in nature have some numerical arrangement (ie. come in 2s, 3s, 4s, 5s, etc.) Show the students an example of leaves, needles or petals and ask them how many are grouped together. Have the students find examples of other things that have a definite numerical arangement. Summarize by asking students: What were the different number arrangements that they found today?

4 Stop Sign! Ask students to explain what shapes are. Have the students identify your shape outlines and ask them to find examples in nature. What shapes did you find the most of? least of? Which shapes do they like best?

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5 Stop sign! Another way to describe objects is by their texture. What does texture mean? (Texture is the description of how something feels.) What words describe textures? Ask each student to find an example of two opposite textures you assign (eg. rough/smooth, prickly/fuzzy, slimy/dry, slick/coarse, sharp/dull, soft/hard). When they return, pair off students. Have one member of each team take turns closing his/her eyes and describing which texture is placed on his/her hands. Try it again with two different textures.

6 Stop sign! What are patterns? (Patterns consist of a repeating series of shapes.) Have students find examples in nature. How are the patterns repetitious?

7 Stop sign! Tell the students they are now expert in finding and describing objects. Show the students a natural object and have them find one that is similar. Come back to a circle and compare each of their objects to yours. How are they similar and different in number, shape, texture and pattern, color and size? Try it again.

Follow-Up Activity

- Set up an "unnature trail" by hiding 10-15 manmade (bright, camouflaged) objects along a 40- to 50-foot section of trail or hedgerow. Have the students look for (but not pick up) the objects and guess how many are hidden there. End the hunt with a discussion on shapes, patterns and unsightly litter.
- Write stories and poems using new vocabulary to describe different objects.
- Visit the school neighborhood. Survey the area for shapes, patterns, textures and numbers. Are they similar or different from the ones you found in nature? Take photographs of interesting shapes, patterns and textures.
- Make a map of your neighborhood. Are there patterns developed by streets, homes, railroad tracks, etc.?

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Investigating Spiders

UNIT CONCEPTS

- The body parts of a spider typically consist of the cephalothorax, abdomen, eight legs, six to eight simple eyes, sharp-pointed, poison-equipped, clawed mandibles or mouth, and spinnerets.
- An adaptation is a physical feature that improves a plant's or animal's chances of surviving and reproducing.
- The two major groups of spiders are hunting spiders and cobweb spiders.
- The major types of hunting spiders are ground spiders, crab spiders, jumping spiders, and running spiders.
- Cobweb spiders construct four types of webs: flat webs with tube as spider's shelter; net-like webs, spider lives on underside of web; round or orb webs made of threads radiating from a common center; webs including random loose bands of silk.
- Spiders have evolved a large number of adaptations which help insure their survival.
- Spiders are carnivores, feeding mainly on other invertebrates.
- Spiders are an integral part of terrestrial ecosystems.

OBJECTIVES

- List the major body parts of spiders and describe the function of each body part.
- Define adaptation.
- Describe two major groups of spiders.
- List three types of hunting spiders.
- List three types of webs made by cobweb spiders.
- For a given habitat capture or observe at least one spider and describe at least three adaptations of the spider.
- State at least two examples of evidence of what spiders eat.
- List three ways spiders affect their environment.

MATERIALS

plastic containers
data sheets
bug boxes
hand lenses
spider field guides
pencils
lapboards

MAJOR CONCEPTS

Diversity
Adaptations

GRADE

3 - 6

TIME

1.5 to 2 hours

SEASONS

Summer
Fall

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Lead-up Activity

Pre-trip discussion of spiders should include spider characteristics and differences from other invertebrates. An investigation of the classroom, school building and schoolyard should reveal some examples.

Field Activity

1 Today we are going to explore the fields and forests to discover all we can about spiders. What are spiders? (Spiders have eight legs, two body parts—cephalothorax and abdomen—six to eight simple eyes, poison-equipped jaws, spinnerets.) Can someone give an example of a spider?

2 To help us learn about spiders we are going to fill in an information sheet about spiders. Give each student a data sheet, pencil and lapboard. We will fill in the information sheet together for a spider I have here, then you will be able to do it yourself when we get to the area we are going to explore for spiders. Let's fill out the data sheet together.

Spider drawing description—Draw a picture of your spider. Describe the things that impressed you about your spider.

Habitat—List the area in which you found the spider.

Where found—Was the spider or web on the ground? Under rocks, twigs or leaves? On a bush? In a tree? On a building? How high off the ground was the spider or web?

What was the spider doing when you found it?

Web type—If your spider had a web, draw a picture of it. How did it feel? Be careful not to destroy the web. What type of web was it?

1. Flat web—closely woven of long threads crossed by finer ones in all directions and connected with a tubular nest where the spider hides.
2. Net-like web—made of smooth threads in large meshes running in all directions, without a tube nest. Spider hides upside down on bottom of web.
3. Round or orb web—made of threads radiating from a common center, crossed by circular loops and spirals, some of which are sticky.
4. Webs including loose bands of silk throughout the structure.

Spider food—Is there any evidence of what your spider eats or was eating?

Adaptations—What is an adaptation? (An adaptation is any physical feature that helps a plant or animal survive and reproduce.) What adaptations does your spider have that help it survive? Is it different from other spiders you may have seen before? Look over your spider closely to find out what things help it survive.

How does the adaptation help—State how each adaptation helps your spider.

Spider's effect on the environment—What do you think your spider does to or for the environment? Why do you think that?

If time permits, find the description of your spider in the field guide and find out more about your spider.

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3 Field
Visit a field area. Give each student a plastic container or bug box. Have each student locate and observe or capture a spider. Have them record the required information on their data sheets. Where would you find a spider? (Spiders can be found just about anywhere: under rocks, logs, tree bark; webs may be between rocks, bushes, tree limbs, weeds, etc. Many spiders are very small. Encourage the students to examine the area closely for the smaller spiders and their webs.) Form a sharing circle and have each student report on the spider s/he has found.

Forest
Visit a forest area. Repeat the procedure as for the field.

4 Discussion
What adaptations do all spiders have that help them survive? (webs, poison glands, silk, simple eyes, eight legs)

What were some of the adaptations we found for certain types of spiders? (Hunting spiders have modified legs for running, jumping, grasping prey; better eyesight. Cobweb spiders build specialized webs for food gathering and reproduction.) How do spiders survive the winter? (Either by eggs which hatch in the spring or they hide in debris for the winter.)

Did we find a lot of different spiders today or were they mostly the same? Were the spiders all found in the same types of places or different places? In how many different areas did we find spiders?

What role do spiders play in the environment? What effect do they have on their environment? (help control insect populations and are part of the food chain; they may be eaten by birds, small mammals, other spiders and insects.) Can we construct a food chain which includes a spider in it from what we have found today? What else do spiders eat? What else are they eaten by? What would happen if spiders disappeared?

Do you think spiders are good or bad? (Students should realize that spiders are neither good nor bad but become so when human values are applied to them.)

Follow-Up Activity

- Locate spider web(s) in the school, school lawn or at home. Record what happens to the spider and its web over time. Is the spider always home? What happens to the web? Is the web repaired by the spider? Is there evidence of what it eats, of how spiders reproduce?
- Write a report about "My Spider Web."
- Read *Charlotte's Web* to the class.

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Investigating Spiders

Student Data Sheet

1 Draw your spider

2 Habitat where found

Describe your spider

Where was spider found

What was your spider doing when you found it

3 Web type or draw a picture of web

Where was web found?

Spider food

4 List adaptations of spider

List how each adaptation helps spider survive

Spider's effect on environment

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Investigating the Water Cycle and Watersheds

UNIT CONCEPTS

- Water is essential for life and is one of the basic needs for all life.
- Water is a finite resource and is recycled and made available to all living things through the water cycle.
- A watershed is the area drained by a stream or rivulet whether it is permanent or intermittent.
- Within its boundaries the watershed supplies water to all living things.
- People may have a direct impact on the quality and quantity of water within a watershed.

OBJECTIVES

- List the steps in the water cycle and explain what occurs to water at each step.
- Define watershed.
- State four ways human activities may affect a watershed.
- State four ways humans may protect a watershed.

MATERIALS

bucket for each student
filter bucket
topographic maps
water source
paper
pencil
lapboard
aluminum foil
2 enamel pans
small sprinkling can

MAJOR CONCEPTS

Cycles

GRADE

4 - 6

TIME

1.5 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

- Collect water samples in quart jars from a variety of sources, including home or school water supply, puddle on parking lot, mud puddle on lawn or field, stream, pond, effluent from sewage plant or factory, etc. Place the samples on a window sill in the sun. For each sample record the color, odor, particles in water or anything else you observe about the water. Observe the samples for two weeks. Each day record what you observe about each sample. If a microscope is available, you may want to examine drops of water from different samples. What changes occurred over time in the samples? Did any samples stay the same? If some samples now have plants and animals where did they come from? What do you think caused the changes in the water?
- Familiarize students with reading and understanding topographic maps.

Field Activity

Water Cycle

1 How many people took a shower or bath this morning? Brushed their teeth? Had a drink at the school fountain? Did you use all the water? Where did the water go you didn't use?

2 Today we going to learn about water. Water is one of the basic needs for life. What are the others? (food, air, water, space and shelter)

3 First we are going to visit the stream. Where does the water come from for this stream? The source of water for the stream is precipitation (rain, snow, sleet, hail, fog) from clouds. How did the water get into the clouds? Have students get their hands wet in the water. Then have them shake their hands very hard until they are dry. What happened to the water? (it evaporated) What's evaporation? (Water changes from a liquid to a gas.)

4 Why can't we see the water vapor? How do we then get clouds?(Water vapor condenses on tiny salt or dust particles to form a cloud.) What does condense mean? (Water vapor changes to tiny water droplets. Remember these droplets are very, very tiny.)

5 We are now all going to be clouds. We've got to get our water from here to where the clouds are. Have students fill their buckets with water. Since we can't fly, we will get closer to the clouds by running up this hill. Lead the run up the hill. (The hill should not be too steep, but you should run far enough so the students are out of breath.)

6 Being a cloud is hard work. Who does the work for real clouds? (The sun evaporates water by heating which allows water vapor to escape from the liquid.) What happens when the water in the clouds gets too heavy to stay up? Have students rain by flinging their buckets of water into the air.

7 What happens to rain after it reaches the ground? (Rain either runs off, sinks into the ground or evaporates.) What happens to the water that sinks into the ground? We just happen to have a model of the earth here (filter bucket) and we will see what happens to water which seeps into the soil.

8 Pour a bucketful of muddy water into the filter bucket held by students. Water should trickle through the filter bucket and be caught as clear water in another bucket. What happened to water as it traveled through the bucket? The same process occurs as water passes through the ground to the water table. Is there anything that may be bad for groundwater? (Some manmade pollutants aren't filtered out by the rocks and soil and make groundwater unfit for use.)

9 Where does the water go from the water table? (It is evaporated from lake and stream surfaces, flows to the ocean in streams or is tapped by man through wells.)

10 What cycle have we described? (water cycle) The water cycle contains all the water on the earth. Is there more water or less water on the earth than there was 10 years ago? 100 years ago? Why? Is there more or less usable water on earth today than 10 years ago? 100 years ago? Why? Knowing this, how do you think we should treat our water resources?

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Watersheds

1 Prepare demonstration watersheds if you haven't already done so. Take a sheet of aluminum foil and fold it in half. Cut the foil so you either have two hexagons or two triangles whose tops have been cut off. Both figures should be attached to each other. Fold your figure so that a peak is formed by the line connecting each figure. Place the two pans at the bases of the figures. Crinkle the foil on each side of the peak so it funnels water down the side of our mountain.

2 Earlier we talked about what happened to precipitation when it hit the ground. What may happen to it? What determines where runoff will go or where water will soak into the soil?

3 To show where the water goes, we will visit Foil Mountain. Foil Mountain is a steep ridge with two lakes at the bottom of the mountain on each side. What will happen to rain that falls on top of the mountain? Take the sprinkling can and "rain" on the mountain. Have students observe where the water goes. Water landing on each side of the mountain flows to its respective lake. Each of the sides of Foil Mountain forms a watershed. What is a watershed? (A watershed is the area drained by a stream or rivulet whether it is intermittent or permanent. Intermittent streams do not flow all year long.)

4 Let's take a look at real watersheds on a map. (Review with students what the different symbols on the map represent if necessary.) First find this area on the map (or your school). Can you find a watershed? (If students have trouble doing this, remind them that the high points of the land determine where the water goes and that all the water should flow into one stream.)

5 Most watersheds are part of larger watersheds. Find a small watershed and the next two larger watersheds of which it is a part. Most streams in Pennsylvania are part of the Delaware River, Susquehanna River, or Ohio River watersheds.

6 Look at the area of one of the watersheds shown on your map. How big is it? We earlier said that human activities might affect the quality of the water. What activities in this watershed might affect the water quality? (highways, farms, houses with on-lot sewage disposal and wells, industry) For each answer discuss how each would affect the quality of the water. How could we find out whether they were affecting the stream and watershed? (We could test the stream chemically and/or find out what animals lived there. We could test springs in the watershed. We could find out whether there were any fish kills or whether any wells had been closed to human use.)

7 Are they any other things that may affect the water quality in a watershed other than human activities within the watershed? (acid rain) Are there things people can do to improve water quality in a watershed? Why is it important to protect watersheds?

Follow-Up Activity

- Identify the watershed in which the children live using a topographic map. How large is it? Using the map, have them identify potential sources of environmental problems.
- Walk the stream to find visual clues to things affecting the stream. Do chemical and biological investigations of the stream. Compare results. Can you identify problem areas?
- Form a junior watershed association in your class to protect your watershed. Pick a name and write objectives for your group. Investigate water use in the watershed including farm, industry, school and home. Monitor the water quality of the stream. Discuss different types of water pollution. Invite resource people from the Soil Conservation Service, Fish Commission, Department of Environmental Resources, and local water and sewer authority to discuss how they protect our water resources. Visit some of the areas where they work.
- Report your findings to the PTA or other community groups.

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Math and Compass

UNIT CONCEPTS

- The compass is a simple instrument used to find direction.
- The needle of a compass is a magnet which is attracted to the magnetic pole of the earth. In the northern hemisphere the needle is pulled to the direction of north which allows us to determine other directions.
- All directions are in relationship to the direction north.
- A compass can be used to follow a set of azimuths to a predetermined location.

OBJECTIVES

- List the parts of a compass and the function of each part of the compass.
- State why a compass can be used to find directions.
- Given an azimuth, set a compass for that azimuth and continue on that azimuth for a given distance.
- Use pacing to determine given distances.
- Given an ordered set of azimuths and distances between azimuths, successfully complete a given compass course.

MATERIALS

Silva compass
100-foot string
compass course cards

MAJOR CONCEPTS

Problem Solving

GRADE

5 - 6

TIME

1 to 1.5 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

Read about and discuss the exploits of early European explorers and the importance of the development and use of the astrolabe and compass to their journeys. Have students research different methods of finding direction from ancient times to the present.

Field Activity

1 Today, like the European explorers of old, we are going to find our way through an unknown and uncharted area full of surprises. Instead of a vast uncharted ocean like the explorers, your journey will take you through the unknown areas of the forest. Does anyone know what instrument the early explorers used to find direction?

2 Does anyone know how to use a compass? (Depending on their expertise some adults or students may be used as helpers. Pass out a compass to each student). Before we learn to use the compass we should become familiar with the main parts of the compass.

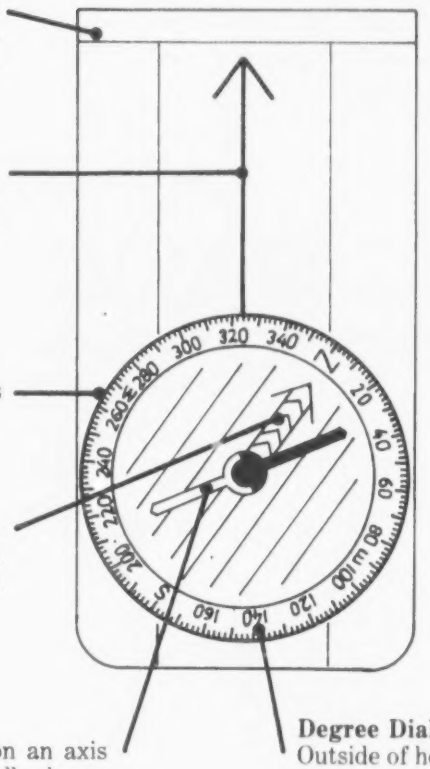
3 Let's examine our compasses. What parts make up the compass? What is the function of each part? See diagram and description.

Base
Provides a level area on which the compass is placed. The compass must be level or it will not work correctly.

Direction of Travel Arrow
Simple red arrow on base of compass. When a direction you want to travel is correctly set, this arrow denotes the direction you follow.

Compass Housing
Secures working parts of the compass to the base.

Orienting Arrow
Stationary arrow on base of compass within compass housing which when aligned with magnetic needle indicates the direction north.



Magnetic Needle
Magnetized needle turns on an axis within the housing. This needle always points north, unless interfered with by an outside source of magnetism.

Degree Dial
Outside of housing is divided into 360 equal parts or degrees. The degree marks allow you to follow a specific direction.

4 Before we learn how to use the compass maybe we should talk about how it works. Why can we use a compass to find various directions? Are there any clues in the parts of the compass we talked about? (the moving needle is magnetized) Magnets are attracted to? (certain metals such as iron, steel, nickel) What might this magnet be attracted to? (There is an extremely large area of metal or magnetism within the earth near the north pole to which the needle is attracted.) That is why the needle always points north. However, since it is a magnet what will happen if a source of metal is placed very close to the compass? What should we then be careful of when using the compass?

5 Have the students stand in a line, arms-width apart facing you. How can we use the compass to find a direction we would like to travel? Remember the compass is divided into 360 degrees, the same as a circle. Each one of these directions is called an azimuth. The word azimuth stems from the Arabic words "all" and "zimuth" meaning "the way." Suppose we wanted to find the azimuth 60°. What would we do?

1. Turn the compass housing so the 60° mark is in line with the direction of travel arrow.
2. Hold the compass level in the palm of your hand, chest-high, with the direction of travel arrow pointing the way you are facing.
3. Turn your whole body including your feet slowly around until the red magnetic needle in the compass housing lines up with the orienting arrow on the bottom of the compass housing.
4. Which way are both of these arrows now pointing? (north)
5. Which way is the azimuth 60°?

(Azimuth of 60° is at the direction of travel arrow. This is the direction you would go. Have everyone follow this procedure and face in the direction of a 60° azimuth.)

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6 Repeat this procedure for azimuths of 120°, 180°, 270°. For each azimuth what enabled you to find that direction? What did you have to know? (You had to know the direction of north.) Why? (All azimuths or directions are in relation to the direction or azimuth 0°, 360° or north. If you cannot find north for whatever reason the compass will not work correctly.)

7 Now that we know how to find different azimuths, we are going to practice a few simple azimuths.

1. First mark the spot where you are standing with a twig or small stone.
2. Set your compass for an azimuth of 0°. Go 10 feet in that direction. How did you know you stayed on the azimuth of 0° and walked a straight line? What can you do to make sure you stay on the azimuth? (You sight along the direction of travel arrow, pick an object that intersects or hits that line, then walk toward the object. You do not need your compass again unless you want to continue past the object you picked.) What types of objects should you pick as landmarks? (trees, rocks, posts, signs—any small, immovable object) What types of objects shouldn't you pick as landmarks? (large objects such as cars, buildings, lakes or objects that may move, for example the tree with a bird in it) What should you do if you come to an object you cannot walk through such as a bush or tree? (Walk to opposite side of the obstacle and find the azimuth again and continue from that point. Remember to include the distance you walked around the obstacle.)
3. Are you sure you went 10 feet? How can you be sure? (We could measure the distance, or we can find out the length of one step and use that as a unit of measurement.) To find a comfortable walking step we have a 100-foot string which is marked with a ribbon every 10 feet. If we adjust our step to 2 feet or 2.5 feet we can simplify matters greatly. If our step is 2 feet, how many steps will we go in 10 feet? So every 5 steps is 10 feet.
4. So we count 1,2,3,4,5—10; 1,2,3,4,5—20; etc. If our step is 2.5 feet, what number can we count by? (Fives: 1,2—5; 1,2—10 1,2—15; etc.) Let's practice our stride along the string. You should hit each ribbon on the string by adjusting your stride to 2 or 2.5 feet.
5. Continue with azimuths of 90° for 10 feet, 180° for 10 feet and 270° for 10 feet. The students should return to their starting places.

8 From the same starting place, try the following sets of azimuths and distances. Each time the students should end up where they began. The number of exercises you do will depend on the students' demonstrated skill and interest.

40° for 15 feet
160° for 15 feet
280° for 15 feet

0° for 20 feet
60° for 20 feet
120° for 20 feet
180° for 20 feet
240° for 20 feet
300° for 20 feet

245° for 20 feet
317° for 20 feet
29° for 20 feet
101° for 20 feet
173° for 20 feet

9 Now that you have passed your explorers test and know how to use the compass and how to estimate distances through the forest, we are going to send you out into the forest to find your way with your compass. Group the students in pairs or trios. Give each group a compass course card. All azimuths end at trees or other objects which are marked by a tack and flagging on the opposite side. Show each group its starting point and have the students take turns determining the azimuths and walking the distances. Circulate among the groups to insure none are having problems.

10 What difficulties did you have in following the course? If the early explorers had these types of compasses do you think they would have navigated their ships correctly? What other aides or help might they have had in reaching their destinations?

Follow-Up Activity

- Have the students make a simple compass. Magnetize a darning needle by rubbing it with a bar magnet. Balance the needle carefully on a cork floating in a dish of water. Wait until the water is still. What happens to the needle and cork? Which way is north? Check with a regular compass.
- Experiment with disrupting a compass with pieces of metal, coins, belt buckles, etc. Which things affect the compass, and which do not? Why?
- Treasure Hunt
  Have groups of students set up their own compass courses in the school yard or nearby park ending at buried or hidden treasures. Have them exchange course cards. See which group finds its buried treasure first. Be sure to check courses beforehand to make sure they are correct.

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Natural Community Profile

UNIT CONCEPTS

- All organisms require food, water, air, and cover or shelter to survive.
- A community is a group of plants and animals living together in an area that meets their special needs for energy and nutrients.
- All plants and animals interact with their surroundings and one another.
- Human communities are similar to natural communities in that they attempt to meet the special needs of the people living in the community. They are also subject to the same ecological principles that govern natural communities.

OBJECTIVES

- List four requirements for life: food, water, shelter, air.
- Define community.
- State how at least three plants and three animals meet their needs in the forest community.
- Diagram the interrelationships among the plants and animals in the community in which they live.
- Compare the natural community investigated with the human community where the student lives.

MATERIALS

lapboard
paper
pencil
data sheets
string

MAJOR CONCEPTS

Community
Diversity
Interrelationships

GRADE

4-6

TIME

1.5 to 2 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Map the human community around your school. Be sure to map enough area to include all the ways people meet their needs. Include all buildings, streets and activities that occur in your community around the school. All living things require food, water, air, and shelter or cover to survive. Discuss with your students how the human communities meet the needs of the people that live there. What happens when these needs are not met?

Field Activity

1 What do all plants and animals need to survive? (Food, water, air, and shelter or cover) Today we are going to find out how plants and animals meet their needs in the forest. To do that we are going to take a survey. What is a survey?

2 Our survey will include finding out which plants and animals live in a part of the forest. First we must determine the area of the forest we want to survey. Choose a central landmark (large rock, stump, tree) as the center of your area. With students, lay out four quadrants around the central landmark. These may be measured with a 10- to 20-foot string, or you can designate appropriate trees, stumps, rocks, etc. as boundaries to your area.

3 Divide group into smaller subgroups. Each group member should make a map of the area. On the map they should locate and label the various plants, animals and nonliving things. (rocks, trails, animal signs) Students do not have to identify plants and animals to species; however, it is helpful to differentiate among birches, maples, oaks, etc. or families of insects.

4 Students should next select three of the plants and three of the animals from their areas and investigate and record how these plants and animals meet their needs?

5 How many different plants did you find? Were there more larger plants or smaller plants? Why? Can we classify these plants into different groups? Do you think all the understory plants will one day be canopy plants? (No, all of them will not be able to meet their needs to become canopy plants.) What may prevent them from meeting their needs?

6 How do plants meet their needs? Where do they get their food? (Through photosynthesis where the sun's energy is used with water and carbon dioxide to form a sugar or food. Some plants, like mushrooms, live off dead and decaying plant material.) How do they get their water? (through root system in soil) How do they get their air? (directly from atmosphere) How are trees protected or sheltered? (bark, grow close to other trees which break wind, grow in valleys or hillsides away from wind, grow thorns, etc.) Do all trees meet their needs the same way? How do trees help one another?

7 How many animals or animal signs did you find? Do animals meet their needs the same way as plants? Have several students identify one of the animals they found and how the animal meets its needs. (Be sure that both carnivorous and herbivorous animals are represented.) Do the animals depend on the plants? (Yes, to illustrate pick several animals and trace their relationships to plants back through the food chain.) Do the plants depend on animals? (Many plants are pollinated by animals.)

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8 All the plants and animals we found today perform special roles or jobs where they live. (You may want to discuss producers, consumers and decomposers here.) What role does an oak tree play? What role does a honeybee play? How about your favorite plant or animal? What role does it play? Each special role or job a plant or animal plays in the environment is called? (A niche) On your data sheet write all the plants, animals and non-living things you found today. Each plant or animal fills a special job or niche that helps one another. Where you live many people have jobs that help you and other people. What jobs do people have where you live that help you? (trash collectors, carpenters, bakers, grocers, etc.) People living together and helping one another are called? (A community) What do you think a group of plants and animals living together and helping one another is called? (A community is a group of plants and animals living together in an area that meets their special needs for energy and nutrients).

9 How do plants and animals in a community help one another? On your data sheet draw lines between the plants, animals and the things they depend on to meet their basic needs. Is there anything we found that is not related to anything else? Is there anything that helps everything? (the sun) The members of the community depend and interact with other parts of the community. They are all interrelated.

10 Is a human community like a natural community? Let's look at the map you drew. The map represents a _____ all of whose members are _____. Now take your map and imagine what each member of this natural community would be if it were a part of the human community. Record what you think it would be. For example, what would deer droppings be? (sewage plant) What would an oak tree be? (food store) Have the students transform their maps.

11 Did you find a role for each part of the natural community in the human community? Which community works better or more efficiently? What do people have to do that members of a natural community do not have to do? (Human communities import food and water and export wastes) What would we have to do to be more like a natural community? (Live in smaller communities and take care of more of our basic needs ourselves.) Do you think we could do that? Why or why not?

Follow-Up Activity

Plan a model community that meets the needs of its members with as few environmental problems as possible. Be sure to meet the community's needs for air, water, food, shelter and any other needs the students feel are important and necessary.

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Natural Community Profile

Student Data Sheet

1 Draw a map of your area. Be sure to include all plants, animals, and nonliving things.

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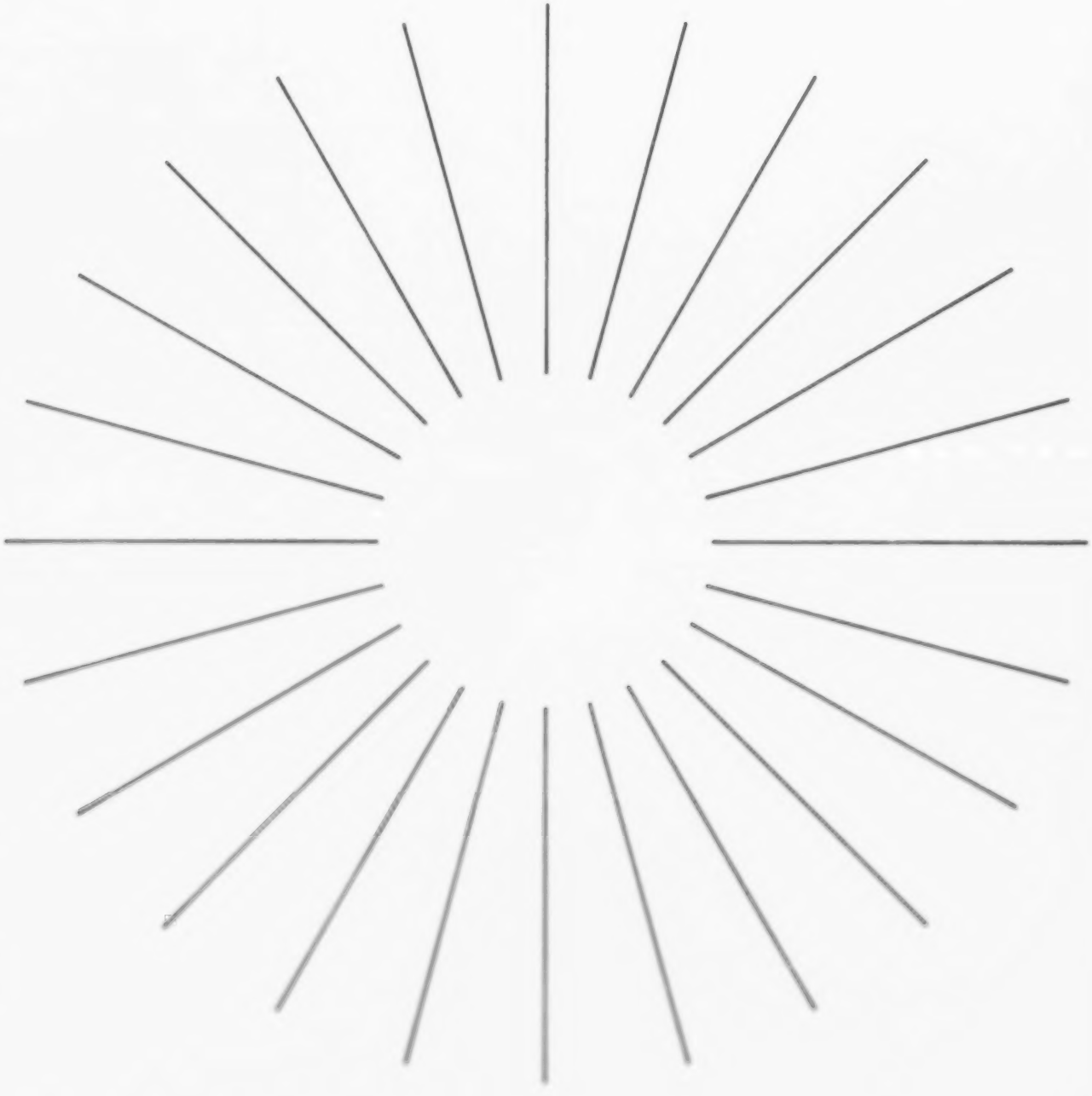
2 For three animals and three plants that you found in your area, list how each plant or animal meets its basic needs.

PLANTS	Food	Water	Air	Shelter
ANIMALS				

3 List all the plants, animals and nonliving things found in your area on the blank lines. Draw lines between the plants and animals and the things they depend on to meet their basic needs (food, water, air, shelter).



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Outdoor Problem Solving

UNIT CONCEPTS

- Effective problem solving involves a well defined process of data collection, problem definition, identifying alternative solutions, developing a plan of action and evaluating the implementation of the plan of action.
- Group motivation, communication, cooperation and acceptance of others' abilities and contributions are essential to effective group problem solving.

OBJECTIVES

- List the six steps of problem solving: collecting data, defining the problem, identifying alternative solutions, evaluating alternative solutions, developing a plan of action and evaluating the implementation of the plan.
- Identify four concepts of group interaction necessary for effective problem solving.

MATERIALS

- See description of each activity

MAJOR CONCEPTS

Problem Solving

GRADE

6 - 12

TIME

2 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

The Outdoor Problem Solving activity is designed as an introduction to the problem solving process. Therefore, no lead-up activities are offered.

Field Activity

Facilitator's Note: The following activities are designed to introduce students to the problem solving process. Although the activities are exciting and fun for participants, the discussion at the conclusion of each activity should emphasize the process which enabled the group to complete the activity.

The facilitator's role is critical to the successful completion of the activities. The leader relates to the students the situation, ground rules and safety precautions for each activity. S/he may also modify the activity so it is difficult for the group members to accomplish, but not so difficult so that the activity cannot be completed or leads to an excessive amount of frustration.

During the activity, the facilitator's main responsibility is to ensure the safety of group members. S/he should remind the participants of their objective, offer suggestions or modify the activity once it is under way only if the frustration level of the group has reached a point which discourages participation or the completion of the activity.

For most of the activities, there is more than one way to solve the problem. The facilitator should stress group communications, cooperation and respect for other group members' abilities, limitations and contributions. Solutions should include completion of the problem by all group members. Generally, if all group members do not successfully complete the problem, the whole group must start over. This ensures the inclusion and participation of all group members in the solution.

Each activity lists equipment, activity site, activity task and activity procedures.

Activities should be grouped so there is an increase in problem difficulty for participants as the activities progress. Participants need not complete all activities.

In addition to discussing the elements of the problem solving process, some additional discussion questions to be included, depending on the group's interaction, are:

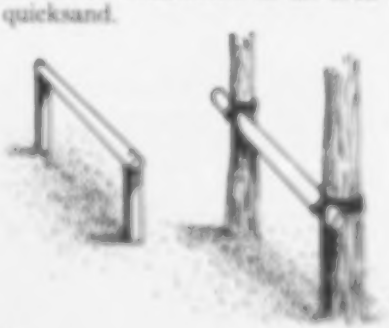
What hindered your group in solving the problem? What helped your group solve the problem? Was anyone frustrated? Why? Was anyone frightened during the activity? Why? Was the fear warranted? Did the activity help the person in any way? What changes occurred in the group as you progressed through the activities?

Sounds

Equipment
Blindfolds, cards with animal names printed on them.
Site
Lawn area or room clear of chairs.
Task
Participants form a line with largest animal on one end, smallest animal on other end.
Procedure
1. Blindfold all participants.
2. Give each participant a card with an animal's name on it. Whisper the name of the animal to the participant and be sure that s/he can make that animal's sound.
3. Randomly relocate the participants with each person facing toward the center of the group.
4. At the command "go" participants may only talk to one another by making the sound of their animals. They are to form a line with the largest animal at one end and smallest animal at the other end.
5. The facilitator may help the group members decide whether they are finished by starting at one end of the line, tapping each person in turn on the shoulder, and having them make their sounds. If the group members are dissatisfied with their line, they can rearrange themselves to form the proper line.

The Beam

Equipment
One log 6-8 inches in diameter, twine or rope for lashing.
Site
Log should be lashed 6-7 feet above the ground between two trees, or bolted to the top of two 8x8-inch beams. The area 6 feet on each side of the beam should be dug out to a depth of 6 inches and wood chipped. A boundary 4-5 feet wide underneath the beam should be established as an area of quicksand.



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Task
Group travels over the top of the beam without the use of any additional materials and without any individuals dropping into the "quicksand."
Procedure
1. Your group is being pursued by a band of savages. You come to a stretch of quicksand. Everyone must get across the quicksand by going over top of the beam.
2. Participants may not touch the quicksand or go around it. If anyone does, the group must start over. No natural objects may be used to help people over the beam.

Ravine

Equipment
50 feet of ¾-inch rope; 5- to 7-inch diameter log, 3 to 4 feet long.
Site
Three-quarter-inch rope should be secured to a horizontal branch 35 to 45 feet off the ground. The end of the rope should be braided. Area beneath the tree should be free of rocks, roots or other obstacles for a distance of 30 feet on each side of the rope and for a width of 20 feet. Two to three inches of wood chips is preferable for a covering.

Task
Group travels across imaginary ravine using only the rope and supply log.
Procedure
1. The group is hiking in the Alaskan wilderness when a pack of hungry wolves begins stalking them. To reach safety, the group must cross a deep ravine. Unfortunately the rope suspension bridge across the ravine has broken and only one rope remains. The group members must take supplies with them. If a person or the supplies fall into the ravine, the group must start over.
2. Natural materials may be used to get the rope. However, once the group has the rope, only the rope and supply log may be used.

Blind Square

Equipment
40-foot length of rope or string, four nails, blindfolds.
Site
Lawn or other open area.
Task
Group forms a square on the ground using the string and nails.
Procedure
1. Blindfold half the group. Give the blindfolded participants the string and nails.
2. The sighted participants may not touch the blindfolded people, the string, or nails.
3. With verbal directions, the sighted people instruct the blindfolded people to make a square on the ground using the string and four nails.

Stretcher Carry

Equipnent
Two strong branches or poles 1 to 2 inches in diameter.
Site
Lawn or other open area; designate a safe zone 20 to 30 yards from accident scene.
Task
Transport an injured group member to safety on a stretcher made only of natural materials.
Procedure
1. Your group is hiking in a forested area. You smell smoke and a strong wind soon blows a forest fire in your direction. In your haste to escape, a group member falls and is severely injured. A short distance away is a fire line. You will be safe from the fire beyond that point.
2. The group must construct something made of natural materials to carry the victim to safety. Only natural materials may be used.

The Iaze

Equipnent
Blindflds, several hundred feet of rope, -foot, 1- to 2-inch diameter woode poles or existing trees.
Site
Eitheran open or wooded area.
1. In oen area free of rocks, holes, etc., pund poles into desired maze configration. Tie string to poles to createhe maze. Be sure the entrance and exs are at different places in the maze.
2. In a wooded area, preferably a conifer pntation, clear the ground of fallen anches, rocks, fill in holes, etc. Be surto remove all branches of trees to a hght of seven feet. Tie string to trees to create the maze. Be sure to include an entrance and exit. You may want to map the area and create the maze on the map before actually constructing it.
Task
Blindfolded participants must find their way out of the maze.
Procedure
1. Blindfold all participants some distance from the maze so they can see it but cannot discern the route or the maze.
2. The group is inside a hotel when an explosion occurs. Everyone is blinded by the blast and must find a way out of the building to escape the ensuing fire.
3. Take the participants to the maze in pairs or trios. Have them feel the left and right sides of the maze.
4. Give them the following instructions: they may use either the right or left side; they may not duck under any string; the leader will inform them when they have completed the maze; if they return to the entrance, the leader will return them to the maze.

Team On A T-Shirt

Equipment
T-shirt or towel.
Site
Lawn or other open area.
Task
The entire group must stand on the T-shirt for 10 seconds.
Procedure
1. The group's boat is sinking in the North Atlantic. The group must evacuate to an iceberg floating nearby or drown or die of exposure in the frigid waters.
2. No participant may stand off the T-shirt. Participants may support each other.

Three Feet Up

Equipment
Two 7-foot, 6-inch diameter logs, one 15-foot, 8-inch diameter log. One 20-foot, ½-inch diameter rope.
Site
Lawn or open area. Any other area should be covered with two to three inches of wood chips.
Task
Using the equipment, support the group three feet off the ground for one minute.
Procedure
1. A news bulletin on the radio reports a dam has burst a few miles upstream from your position in the steep stream valley. A wave of water about three

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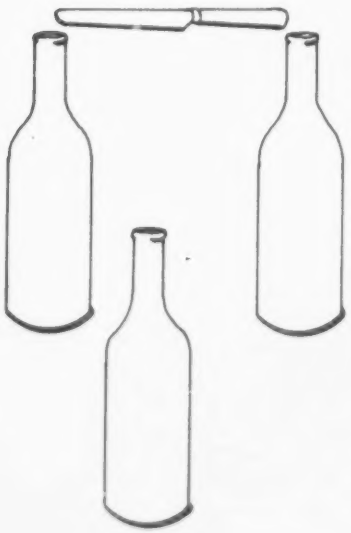
feet high will reach you in about eight minutes; there is not enough time to escape the valley.
2. The group must get all members three feet off the ground before the wave arrives or be washed away in the turbulent flow.

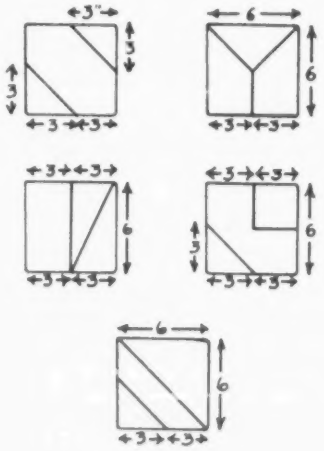
Bottles

Equipment
Three empty bottles, four table knives, one drinking glass filled with water.
Site
Place the three bottles upright on a table or the floor in an equilateral triangle. The length of a side should be slightly longer than the length of one of the table knives.
Task
Using the four knives construct a platform on top of the bottles strong enough to support the glass of water.
Procedure
1. The three bottles may not be moved. No knives may touch the table and the glass cannot be supported over a bottle; it must be between bottles.



Five Squares

Equipment
Envelopes, five squares of plywood or oaktag cut into pieces of shape dimensions shown.
Site
Mix the pieces of all five squares. Randomly pick and place pieces in envelopes.
Task
Each person in group must construct a square of equal size.
Procedure
1. Tell group what its task is.
2. Participants may not talk; they may pass pieces of squares to other people, but they may not take pieces of squares from other people.
3. When each person has a square the task is completed.



Follow-Up Activity

- Have students design their own problem solving activities.
- Have students complete *Six Bits* or *Eight Bits* from the *U. S. Forest Service Process Approach—Investigating Your Environment Series.* This activity reinforces the problem solving process.
- Involve students in an in-depth study of a local environmental problem. Guidance in developing a problem solving approach to environmental education is available from state park environmental education centers.

Plant and Animal Adaptations

UNIT CONCEPTS

- An adaptation is any inherited feature of a plant or animal that improves its chances of surviving and reproducing.
- Plants and animals evolve adaptations over long periods of time.
- Specific plant and animal adaptations enable different plants and animals to fill specific niches in various habitats.
- Changes in a plant or animal's habitat occurring more quickly than adaptations may lead to that plant or animal's extinction.

OBJECTIVES

- Define adaptation.
- List three adaptations that humans possess and explain how these adaptations help them survive.
- List four adaptations that plants possess and explain how these adaptations help plants survive.
- List four adaptations for at least two animals and explain how these adaptations help the animal survive.
- Given a description of or by examining an animal's home or habitat, predict the adaptations an animal living in that habitat may possess.
- Define extinction.

MATERIALS

plastic containers
bug boxes
pencil
data sheet
lapboard
field guides
hand lenses
strainer

MAJOR CONCEPTS

Adaptations

GRADE

4 - 6

TIME

1.5 hours

SEASONS

Spring
Summer
Fall

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Lead-Up Activity

Scatter equal numbers of colored toothpicks on the school lawn. Have the students hunt for toothpicks for one to five minutes depending on the number of toothpicks and size of area used. Have students classify the toothpicks by color and chart the results. Which color of toothpicks did they find the most of? The least? Why?

Return toothpicks to lawn. Tape students' fingers in various ways to make toothpicks more difficult to pick up. Give some students colored glasses. Repeat activity. Who found the most toothpicks? The least? Why? An adaptation is any inherited feature of a plant or animal that improves its chances of surviving and reproducing. What adaptations did each student have?

Field Activity

1 Today we are going to investigate plants and animals for the adaptations they possess. What is an adaptation? (An adaptation is any inherited feature that improves a plant's or animal's chances of surviving and reproducing.)

2 What adaptations do we have that increase our chances of survival? (Answers may vary, but our opposable thumb, upright stature, larger brain and ability to reason are the main adaptations.) How does each of these adaptations help us survive?

3 What adaptations do plants have? Divide your group into groups of three or four students. Give each group a lapboard, paper and pencil. Assign each group a specific plant to examine for adaptations. Each group should identify an adaptation and how it helps the plant survive and reproduce. Each group should find at least four adaptations for its plant. Have the group report the findings.

4 Take group to new location. Hand out the rest of the equipment. We are now going to explore for animals in this area. Each person should find at least two animals. Be sure to put your animal in a plastic container or bug box so it will not get away and so you may examine it. Record important information on your animals on the data sheet. Let's examine an animal together to describe the animal and determine what features are important. (Note: Facilitator should have an example completed with which to go over with the students.)

5 You now will have time to look for your own animals. Where are some good places to look? (under rocks, logs, bark, on tree leaves, limbs, in dead leaves, in the soil, etc.) Remember to replace any animals' homes that you disturb. While students are exploring and investigating their animals, the facilitator should help those who need help in finding animals, interpreting their finds and in use of field guides. Be sure to interact with each student during this time.

6 Form a sharing circle and have students report on one of their animals. If possible, have the students talk about different animals and have them show their animals. How did different animals solve the same problems? For protection? (protective colors, lived in soil, hard shell, able to fly, were flat-bodied to hide under things, etc.) Or eating? (mouths for piercing, sucking, grasping, chewing, etc.) How about water? (hard shell, thin, porous skin) Were there some adaptations animals lacked? Why? (Many soil animals have poorly developed or no eyes. Good sight is not necessary where they live.) Were there any adaptations that only one or two animals had? What did this adaptation help the animals do? Were there any common adaptations for animals living in the soil? In trees? Other areas?

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7 If time permits, visit another habitat that would have several different animals exhibiting different adaptations as those previously found. (Field and forest areas would be appropriate.) Repeat exploring, reporting and discussing session. (The reporting session may be limited to new animals found.)

8 Travel to a pond or stream. Now that you are experts at adaptations we are going to predict what adaptation an animal living in this environment might have. Using the data sheet we will describe a plant-eating animal and an animal-eating animal.

First let's describe the habitat or home in which the animals live. Then using the data sheet, describe your two animals. For each physical feature have the students give reasons why they think the animal would have those adaptations. Also have them explain why they omitted any body parts.

9 Take the strainer and find several animals. Compare these animals using the data sheet with the adaptations the students predicted the animals would have. Were the adaptations similar? If not, why do you think they were different?

10 Today we have looked at different adaptations animals have so they are successful in the habitat or home in which they live. What might happen if an animal's home might suddenly change? What happens when a pond or stream dries up? (Many of the animals that live in the water die because they have gills which are useless in breathing air.)

The same type of thing can happen to large groups of animals. You all have heard of dinosaurs; what happened to them? (They are extinct; they couldn't adapt to changes in their home.) What does extinct mean? (A plant or animal disappears forever from the earth.)

Are there any animals now in danger of extinction? (California condor and bald eagle are good examples.) These species are endangered; they are in a lot of trouble. Why have these animals become endangered? (Again, a change in their habitat; unfortunately people are the cause in many cases. You should give examples as to how people contribute to some animal's problems.)

Is there anything being done? (The Endangered Species Act helps protect endangered plants and animals.) What do you think people could do to protect plants and animals?

Follow-Up Activity

List and discuss the ways people overcome some physical shortcomings or lack of adaptations. How do we change or alter our environment to help us survive? What effect do these changes have on the environment?

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Plant and Animal Adaptations

Student Data Sheet

2 Where was animal found?

1 Draw your animal

3 Describe each body part, and tell how it helps the animal.

Mouth

Wings

Eyes

Color

Legs

Antennae

Body Shape

Other

Tail

Animal's Name

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Reading in the Outdoors

UNIT CONCEPTS

- All organisms need air, food, water and shelter to live. Each has its own way of surviving when one of these is not available or is in short supply during certain times of the year.
- Plants as well as animals have adapted to survive during winter months.
- Different organisms may adapt to winter changes in similar ways.
- When an environment becomes too harsh for survival, organisms must move (migrate), become dormant (hibernate), or die.
- Seasonal changes occur gradually and most organisms have enough time to adapt to the changing conditions.
- Humans also prepare for winter. In some respects humans do the same things as other animals, but only people can change their environment to suit their comforts.

OBJECTIVES

- Describe at least three different interactions among organisms during fall seasonal change.
- Identify at least four different ways in which different organisms prepare and adapt to the onset of winter.
- Summarize the story demonstrating a basic understanding of animal behavioral modification during changing seasons.
- Demonstrate a personal understanding of problems animals and plants face during winter by emotionally identifying with one or more of the stories' characters.
- Compare methods of human preparation for winter survival with those of the stories' characters.

MATERIALS

hand lens
lapboard
paper
pencil
trowel
plastic containers
bug boxes
data sheets
insect identification keys

MAJOR CONCEPTS

Community
Interrelationships
Adaptations

GRADE

5 - 6

TIME

1.5 to 2 hours

SEASONS

Fall

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Lead-Up Activity

- During the fall season of the year many exciting changes occur that make the natural environment of the forest appear very different from summer. Students, for the most part, are quite aware of the obvious changes but unaware of the many animal and plant activities and the reasons for the new activities. People also change in response to the changing seasons. Many of our activities compare directly to the activity of other animals during the fall season.

  In preparation for the reading and subsequent field study, initiate a general discussion of some obvious fall changes occurring in or around the school. Ask the students to prepare a list of the changes they see going to and from school daily. Have them share observations in class and inquire as to how long each of these changes have been taking place.

- Select several different kinds of environments such as a stream or pond, field, and forest. Ask the students to think about the changes occurring in each. Ask them to identify how the changes are similar or different in the various areas. Select some representative animals from each of the environments. Examples are pond-fish, frog; field-mouse, milkweed; forest-tree, squirrel. Ask the students to compare the animal's or plant's behavior in different seasons: summer, fall, winter, spring.

Field Activity

Note to Facilitator
The following activity may be used in a variety of ways depending on specific student needs and objectives to be met. The following are some recommendations for the use of this activity.

1. As an indoor activity in preparation for outdoor investigations concerning seasonal change.
2. As a reading activity in an outdoor setting simulating the forest described in the story text.
3. As a reading for personal involvement with the out-of-doors evoking emotional responses from students and subsequent storytelling or creative writing.
4. As a combination reading activity and discovery investigation in a forest environment.

1 Introduce the story. Take the students outdoors into a woodland or forest area and read this story. This can be done silently as a group or by alternate oral readings by the students. The entire story may be read prior to discussion or parts may be read and discussed.

2 After the story has been read, discuss the important points of the story.

A. As Ralph hovered over the forest below what do you think he was looking for?

B. Apparently Ralph and the woodland birds traveling in flocks were both experiencing the same things. How were they going to prepare for winter? Why don't they remain in the woodland as do many other kinds of birds?

C. How were the chipmunks and red squirrels preparing for winter? Why is it necessary for them to collect seeds in the fall? Do you suppose they were collecting the same kinds of seeds? What do they do with the food they collect? Do they store it in the same place?

D. From the story, what seems to be the major concern of woodland animals like the red squirrel? What other seasonal changes must they be concerned about? How will each adapt to these changes?

E. Why was the snake moving so slowly? Why didn't it try to hide quickly? Why did it go under the ground? Why won't it come out again until spring? How will it be able to stay alive all winter without eating?

F. What happened to the insects Ralph had seen during the summer? How do they adapt to the winter season? Do they all do the same things in preparing for winter? How do the monarch butterflies prepare for winter? What happens to the summer crickets? The butterflies and moths?

G. What changes occur in fall that cause animals and plants to prepare for winter?

H. How do humans prepare for winter? How does human activity compare with animal activity in the woodland?

I. Could this be a true story? If so why do you think it could be? If not, why not?

J. How do you think Ralph felt as he sat from his lookout post and observed how the forest had changed? Why do you think he felt that way? How would you feel if you were Ralph?

K. If you were living in this forest, how would you prepare for winter?

L. What are some reasons why Ralph had to leave the forest? Where did he go?

3 Continue the investigation and discussion of seasonal change with the following field study. Give each student a lapboard, pencil and paper. Assign groups of three or four students to selected areas. In their areas the students should collect the following information:

1. Examine the trees, shrubs, rocks, logs for animal signs. List the animal sign, animal which made the sign, what the animal was doing, and how that animal is preparing for winter.
2. Examine the leaf litter and forest duff for animals. Also dig into the forest soil. List the animals found on the forest floor and in the soil and how these animals are preparing for winter. Is there an advantage to living in the soil?
3. Examine the trees in your study area. List the types of trees found in the area. Do they have leaves? What type of leaves are on the trees? What color are the leaves on the trees? How do trees prepare for winter?
4. Examine the herbaceous plants (weeds). What is happening to the herbaceous plants? How do the plants insure their survival for the following growing season?

Follow-Up Activity

- Have the students tell or write a story about some animal they discovered relating how it is preparing for winter. Ask them to pretend they are the animal while telling the story.
- Visit other environments such as a field, pond or stream. Investigate each and compare how the inhabitants are preparing for winter.
- Have students read about selected organisms and report to the class about how each adapts to winter conditions.
- Have students examine their own home and school environments and prepare reports on how people prepare for winter and how they escape the problems which other animals face.

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Reading in the Outdoors

A Shadow Over The Woodland

One bright October day the shape of a large bird hovered in the sky. The shadow came down slowly closer and closer to the tree tops. The mysterious figure frightened the chipmunks, mice and small birds who felt safe under the big old oaks. Each ran for the nearest covering to hide from the frightening shape. The animals watched the scary shape to see what would happen.

The animals had often seen the large bird. It was no stranger to the forest community. Many times during the summer it came to eliminate one of the community members. The forest animals served as food for the big bird.

The great bird acted differently on this day. His forest friends called him Ralph. A red-tailed hawk, Ralph was a good hunter. He was one of the best at hiding his presence from the small forest critters. Today Ralph seemed worried about something. He was not looking for mice to eat.

Ralph looked over the woodland below. The cold north wind seemed to bother the little animals. The rich green color of the forest trees was fading. Many of the trees had taken on bright, new colors. They told the world they were getting ready for winter. Ralph didn't understand what was happening, but he felt different. He had an urge to leave his favorite hunting place. Something told him which way to fly.

Ralph felt hungry. He decided to land on his favorite lookout post. He wanted to catch a careless mouse or sparrow. He watched the animals on the forest floor. He wondered why they acted differently. He had noticed woodland birds traveling in flocks. They had never done this in the summer. It was very quiet. The birds

didn't sing or call. Many of the song birds weren't there at all. The red squirrels did strange things. They ran gathering walnuts and pine cones. The nuts were stored in hollow trees or in holes in the ground. The squirrels fought over a pine cone as if their lives depended on it.

As Ralph sat in his tall tree he saw a snake slithering slowly through the dead leaves. Ralph swooped down to get a better look. The snake didn't dart away for a nearby rock. Every snake he'd seen during the summer crawled away in the blinking of an eye. This surprised Ralph. The snake disappeared into a hole that led deep into the forest floor. Ralph did not know that the snake would not come out for a long time—not even to eat. Ralph noticed that even the insects couldn't be found. Those he did see moved slowly like the snake. They went to decaying logs or the peeled bark of trees. Just Ralph and the spiders new to the forest were left to hunt.

He sat for a long time. He felt confused and lonely. What was happening? He wished the forest would be like it was all summer.

All the while the chipmunks, mice, red squirrels and small birds hid quietly. They knew that to run about in search of food meant instant death.

Suddenly the great bird spread his wings and flew high in the sky. He flew around his post once, twice, and a third time. The forest creatures watched. The he disappeared in a southward direction. He wouldn't come back for several months.

The forest creatures did not know where Ralph was going. They didn't care. Each had its own special problem in preparing for the winter's harsh temperatures, winds, and snow which would soon blanket the forest floor.

3 Examine the trees in your area.

Type of tree	Does tree have leaves?	What type of leaf?	Color of leaves?	How do the trees prepare for winter?

4 Examine the weeds in your area.

What is happening to the weeds?

How do these plants insure their survival?

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Reading in the Outdoors

Student Data Sheet

Please explore the area you are in to answer the following questions. If you have any questions, please ask your leader.

1 Examine the trees, shrubs, rocks, logs, and forest floor for animal signs.

Animal sign	What was animal doing?	What animal made the sign?	How does this animal prepare for winter?

2 Examine the leaf litter, forest duff, and dig into the soil for animals and animal signs.

Animal sign	What was animal doing?	What animal made this sign?	How does this animal prepare for winter?

Seasonal Changes

UNIT CONCEPTS

- People have sensory feelings about each season.
- Certain factors influence plant and animal behavior during different seasons of the year.
- Plants adapt to the changes of the season.
- Animals adapt to changes of the season.

OBJECTIVES

- Describe two things using your senses.
- List two conditions which influence plants and animals during this season.
- Describe two ways plants are adapting to this season.
- Describe two ways animals are adapting to this season.

MATERIALS

hand lenses

MAJOR CONCEPTS

Environmental Awareness

GRADE

2-3

TIME

1 to 2 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

Discuss what sorts of changes people are making in their clothing, houses and recreational activities for this season.

Field Activity

1 Explain to the students that oftentimes we rely so much on our eyes that we ignore our other senses. Have the students get in a line and either hold hands or put their hands on the shoulders of the students in front of them. Tell them to close their eyes and quietly lead them down a trail for about 100 yards. Form a sharing circle and ask them to share feelings about what the season is like. Is it warm, cold, damp, windy, dry, wet, etc.? What senses did you use to discover this?

2 Ask students if they think plants and animals are influenced by the changes of this season. What factors do they feel influence plants and animals most? The following are the biggest influences for each season:

Winter
Cold temperature, little water, less light, scarcity of food

Spring
Increasing temperature, water and light, more food

Summer
Hot temperatures and less water, abundant food

Fall
Cooling temperature, less water and light, abundant food

3 Thinking about the factors that affect this season, if you were a plant what would you do ***during*** this season?

Winter
What are trees doing in winter? Are they growing? Are they dead? Where are they getting their food? Where are the trees going to get new leaves? Examine some tree buds. What is this? Do you know what is inside this bud? Find buds on other trees. Can you find many plants that aren't trees or shrubs? Are they dead? What do new plants grow from each year? (seeds) Find a seed or fruit. Would animals eat this? What other ways do animals use trees in winter? Look for animal signs.

Spring
What happens to plants in spring with warmer temperatures and more water? Where do leaves come from? Can you find buds in different stages of development? Where do new plants seem to be growing first? Do they get any protection there? From what? Stand or kneel near a place where a plant is growing. Is it warmer, less windy, etc. than open areas? Can you find any flowers? What colors are they? Do they smell? Besides people, who likes to visit flowers? Why? What plants might animals eat here? Can you find any evidence of animals eating plants?

Summer
What are plants doing in summer? What do plants need to grow? How do plants make food? (Plants make food in the green parts of them by taking air and water and sun's energy to produce food sugars.) Can you find a part of a plant that is making food? Is it cooler in the woods or fields? Why? (Shade is one reason.) How do you get cooler in summer? (We often cool off by swimming.) What do plants give off when they make food? (The water given off by plants makes the forest feel cooler than the open field.) Visit the stream in the woods. Is it cooler here than nearby areas? Why? Plants also help animals. How? Look for food for animals and places where animals might live.

Fall
What happens to trees in the fall with lower temperatures and shorter days? How do leaves help a tree? (They make food.) Find a tree with leaves on it. Can anyone explain how leaves make food? (Plants take the sun's energy + H_2O + Air and make food inside the green of leaves.)

The leaves are not green now; are they making food? What color are the leaves? When leaves stop making food, the green isn't working and other colors show up. Find as many different colors as you can. What happens to leaves when trees are not using them to make food? Why do trees drop their leaves? How do they drop their leaves? Do all the trees drop their leaves? How are its leaves different? What evidence can you find that these trees drop some of their leaves but not all of them? What is happening to plants other than trees? Where do you think new plants grow from each year? Can you find a seed? Do seeds move? How do they move? Which seeds would animals eat?

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4 Can animals make their own food like plants? How do they get their food? Do you think there is more food for animals now or at other seasons of the year? Why?

Winter

If you were an animal in the winter what would you do to find food? Can you find food that animals might eat? Can we find any other signs of their activity? Some animals find it takes too much energy to get food to be active in the winter. What do they do? (They hibernate or sleep.) Let's look for places they might sleep. Look in small places too because insects are sleeping too. What happens when an animal hibernates? What kind of homes do animals choose in the winter? What are they trying to protect themselves from? Do animals do anything else to protect themselves from the weather in winter? If you have a cat or dog at home is its coat thicker or thinner in winter? What else do animals do so they do not have to use a large amount of energy in winter? (Some store food, others restrict their movements to favorite areas, some sleep during stormy or very cold weather.) What if you were a bird and would only eat insects and all the insects were gone. What would you do? (Some birds migrate or fly to warmer more suitable areas.) Does anyone else migrate? What do the birds that stay here do to survive the winter?

Spring

If you were an animal in spring with more food and warmer temperatures how might your activity change? Are there any new sources of food? What kinds can you find? Many animals make new homes in the spring. Can you find any animal homes? Why might the animals be making new homes or cleaning old homes? (Many animals will be having young at this time.) Can you find any signs of animals having young? (You may find insect or amphibian eggs.) Many birds are returning from the south now. What is this journey called? Why do these birds return north in the spring? (There is more food and cover.) Can anyone find a bird nest? Is it being used? What is it made of? Do the birds look any different in the spring? (You may see male birds in breeding plumage or brighter colors.) Have the group close their eyes and listen for one to two minutes. What did you hear? Are animals noisier or quieter at this time of year? Why?

Summer

If you were an animal in summer what would you be doing? What problems might animals encounter in summer? (Animals have to contend with higher temperatures.) What do animals do to escape the heat? Where should we look for animals like turtles or salamanders this time of year? Some animals like insects like it warm. Where might we look for insects? Find some insects. What are they doing? What evidence can you find of there being insects present if you cannot find any?

Fall

If you were an animal in the fall what would you be doing? How do animals prepare for winter? Is there a lot of food or a little food for animals to use? How do animals use it? (Some animals will be storing food, others will be eating as much as they can to store fat in their bodies to get through the winter.) Can you find evidence of animals eating?

With cooler weather what happens to the insects? How do insects get ready for winter? (Most overwinter in eggs or pupas.) Can anyone find any insect eggs or pupa? Where should we look? Why? What do the animals do that eat insects? What do many insect-eating birds do? (The journey they make is called migration.) Can you find any evidence that birds are migrating? Have the students close their eyes and listen for one to two minutes. What did you hear? Are the animals quieter now or more noisy? Do you hear the same animals now as other seasons of the year?

Have the students close their eyes and listen for one to two minutes. What did you hear? Are the animals you heard different from other times of the year? Why are they making these sounds?

5 Have students form a sharing circle and have each student describe one plant or animal and what it is doing during this season.

Follow-Up Activities

- Visit an outdoor area at different seasons of the year to observe the changes in plants and animals.
- Adopt a tree. Keep track of and record the changes your tree goes through during the year.
- Visit the school neighborhood. How does the neighborhood change with the season? What are people doing? Are the streets and roads different? Do houses, shops and other buildings change with the season? Are the sounds and smells the same? Keep a log of how the school neighborhood and people change with the season.

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Seeds and Their Adaptations

UNIT CONCEPTS

- An adaptation is a genetically programmed feature of a plant or animal that gives it an advantage in meeting its needs for survival and reproduction.
- Plants require minerals, water, air and energy for growth and reproduction.
- Plants have developed a variety of seed dispersal methods to insure continuation of individual plant species.
- Many plants reproduce by seeds.

OBJECTIVES

- Define adaptation.
- List the four requirements for plant growth and reproduction.
- For a field, forest, and water habitat, list one method of seed dispersal and state how that seed dispersal method aids the plant in reproduction.
- Identify the major means of natural reproduction in plants.
- Identify a plant adaptation that allows young plants an opportunity to grow in optimal conditions.

MATERIALS

dried peas or beans
balsa wood
construction paper
toothpicks
scissors
pencils
cork
feathers
Seed Dispersal Action Cards (OBIS)
tape
rubber bands
glue
balloons
paper clips
plastic bags
cotton

MAJOR CONCEPTS

Adaptations

GRADE

4 - 6

TIME

1.5 to 2 hours

SEASONS

Fall

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Lead-Up Activity

Plant bean seeds in small containers in the classroom under a variety of conditions emphasizing the basic needs for plant growth. Be sure to omit either air, light, or water for several plants. Also have several containers that receive all their needs for growth. Observe the plants for several weeks. Which grew best? Which grew poorly? Which did not grow at all? We can conclude that plants need minimum amounts of air, water, energy and minerals for growth.

We manipulated our plants to give them varying conditions necessary for growth. How do wild plants try to insure proper growth conditions for their seeds?

Field Activity

1 What do I have in my hand? (seed) If we plant this seed, what will it grow into? Will this seed grow anywhere we plant it? What do seeds and plants need to grow? (minerals, water, air, energy) Have students feel the soil. What makes it wet? What is soil made up of? What do we breathe to stay alive? Where do plants get their energy?

2 How do seeds get to places that meet their needs for growth? To answer that question we are going to explore different areas to find what kinds of seeds are found in each area. We are also going to examine the seeds to see if we can discover how they may have gotten there or how they may move to another place.

3 In groups of three or four, give the students 10 to 15 minutes to explore for seeds. Have them collect one of each type they find to show the rest of the group.

Form a sharing circle. Each group will report about its seeds and how they are modified to move to other places. (Examples—colorful berries are often eaten by birds or other animals, pass through their digestive system and are deposited in animals' droppings at new sites. Nuts are buried by squirrels and other animals; those they do not find may germinate and grow. Winged seeds are carried by the wind. Some seeds are catapulted, such as witch hazel and jewelweed.) You will probably also find different methods of seed dispersal in different areas.

When a plant or animal has a feature that gives it an advantage in surviving and reproducing, it is called an adaptation. Do you think the way seeds are spread is an adaptation? Why? These particular adaptations are all known as seed dispersal methods. Let's explore a new area for more seeds.

4 Field
Again, have student groups search field areas for seeds. Repeat sharing circle. In addition to seed dispersal methods found in wooded areas, what new adaptations were discovered? (New examples—hitchhiking seeds with barbs or thorns which may be shaken off or stick to passing animals, including man; parachute seeds with fluffy material)

5 Water
Visit a pond area. In small groups, explore the water's edge for seeds. Repeat sharing circle. Were any new adaptations found? (possibly floating seeds)

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6 How many different adaptations for seed dispersal did we find? What were they? Did any adaptation occur in more than one area? More than one plant?

7 Now that we are experts on seed dispersal adaptations, you are now going to invent your own seed dispersal adaptation. Pass out Action Cards and seeds. Show the students the materials. Each person will modify a seed to perform a task on the card. (Your job is to help those that may have difficulty in modifying their seeds.)

8 Have students demonstrate their seed dispersal adaptations. Which seeds actually use each of the adaptations? What might happen if these seeds did not have these adaptations? Do you think one adaptation is better than the others? Why?

9 Who can remember what an adaptation is? Can you think of other adaptations plants have? What adaptations do some animals have? Humans?

Follow-Up Activity

Complete the activity *Plant and Animal Adaptations.*

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Settlers in the Wilderness

UNIT CONCEPTS

- Different plants and animals live together in areas that meet their special needs for energy and nutrients.
- Our past use of the land influences present and future use of the land.
- Geography of an area determines the type of communities present, and ecology explains the interrelationships between living and nonliving things.

OBJECTIVES

- List five factors an early settler would look for in settling an area.
- Judge the suitability and list the factors for settlement of a given area for farming.
- Give three evidences of past land use in a given area.
- State three ways geography affects the development of human or natural communities.

MATERIALS

topographic maps
pencils
soil auger or trowel
base map
meter or yard stick
paper
lapboards
level
slope pole

MAJOR CONCEPTS

Community
Interrelationships

GRADE

5 - 6

TIME

1. 5 to 2 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

- Familiarize students with the use of topographic maps. Have them locate the school, local churches and other local highways and buildings. In rural areas, some may be able to locate their homes.
- Read with the children accounts of stories of early settlers' life, especially prose written from a child's point of view.

Field Activity

Note to Facilitator
The field activity section of this activity should be done with students role-playing early settlers. Section 1-3 and 5 should be facilitated in a large group. Section 4 should be facilitated in small groups at the study site.

1 Today we are going to be settlers moving into a new area. We are looking for a good place to start a farm and home site. What kinds of things should we look for in determining where we will settle? (might consider soil, water, slope, type and height of trees, types of animals, location of nearby farms or communities) Why would each of these factors be important?

2 Let's see if this map can help us find a place to settle. What information can we get from the map? Is it useful in determining where we want to settle? What areas might we consider for our homesite? Which sites wouldn't you consider? Why?

3 What other information do we need to know? How can we find that information? Each group will visit one of the possible locations for a farmsite. At the site they will gather the information listed on the data sheet.

4 Discuss the importance of each factor investigated and what the results tell us. (Refer to soil data chart from soil study.)

What color was the topsoil? (Generally darker topsoils are richer in organic matter and therefore more fertile.) What color was the subsoil? (Yellow, red, brown, or black forest subsoils are well drained; mottled grey subsoils are poorly drained.)

How deep was the soil? Why is it important to know the depth of the soil? (You would know the plow depth of the soil for growing crops.)

What was the texture of the soil? (Loamy soils have the best water-holding ability and are easily worked.)

How stony was your soil? Why would you want to know how stony the soil is? (would affect the difficulty in plowing)

What was the slope? Slopes of 20 percent or less are appropriate for conservation-minded farming. (Refer to *Exploring the Soil* for procedure.)
Was water available at or near the site?

What types of trees were found at the site? How big were they? What do the types of trees found at a site tell us? (A certain tree favors a certain soil pH. An early settler would have called it "sweet" or "sour" soil.) What pH do trees on your site indicate? Is this pH good for the crops you may want to grow? Why would you want to know how big the trees were?

What signs of animals did you find? Why would an early settler be concerned about what animals were nearby? (They might eat crops or animals; the settler could use them for food.)

Do you think this would be a good place to start a farm? Why? Formulate a report as to why or why not you would settle this area.

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5 Do you think an early settler would have investigated all the things we did? Why? What may s/he have done differently? Is there any evidence here or in other places you have visited that tell us about some of their "good" and "bad" decisions? Is there anything here that tells us how humans used this area in the past? How was the land used and what was its effect?

Each group will present a report on their findings to the large group. The report should state why or why not they would have settled in the area they investigated.

Follow-Up Activity

- Examine a topographic map. Looking at the map what areas do you think were settled first for farming? Why? At first, most towns and industries were located along streams. Why were they located there? Are all the towns on this map located along streams? What happened to enable communities to grow that were not near streams? (railroads and then automobiles) Where are most of the forested areas located? Why do you think they are located there? (soil was too poor and land too steep to farm) Are they any other reasons? (abandoned farms, either because they shouldn't have been farmed initially or through poor management they became poor)
- From the information on this map what natural features affect the location of human communities? What human inventions also affect the location of human communities?
- Discuss what factors should be included when making land use decisions.

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Settlers in the Wilderness

Student Data Sheet

1 Soil

Information on soil should be gathered at three places at your proposed site.

Color

___ Dark—*dark grey, brown to black*

___ Moderately Dark—*brown-yellow brown*

___ Light—*pale brown to yellow*

Color of Subsoil

___ yellow, red brown or black

___ Mottled grey

Depth

___ in. topsoil

___ in. subsoil

Texture

___ Sandy—*gritty*

___ Loamy—*smooth, slick, not very sticky*

___ Clayey—*smooth, plastic, very sticky*

Stoniness

___ Small or no stones

___ Small to medium-sized stones

___ Large stones

___ Rocky

Slope

___ 0 to 3%

___ 3 to 20%

___ 20 to 30%

___ over 30%

Color

___ Dark—*dark grey, brown to black*

___ Moderately Dark—*brown-yellow brown*

___ Light—*pale brown to yellow*

Color of Subsoil

___ yellow, red brown or black

___ Mottled grey

Depth

___ in. topsoil

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Texture

___ Sandy—*gritty*

___ Loamy—*smooth, slick, not very sticky*

___ Clayey—*smooth, plastic, very sticky*

Stoniness

___ Small or no stones

___ Small to medium-sized stones

___ Large stones

___ Rocky

Slope

___ 0 to 3%

___ 3 to 20%

___ 20 to 30%

___ over 30%

2 Water

___ No water

___ Spring or stream

___ Water for transportation

Trees

List types of trees.

Animals

List signs or actual sightings.

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Using the Senses

UNIT CONCEPT

- The five senses (sight, smell, taste, touch and sound) may be used to learn about the environment around us.

OBJECTIVES

- Find an object the same color as a given colored strip of paper.
- Find an object the same shape as a given shape.
- Describe three sounds heard during the activity.
- Describe three smells presented during the activity.
- Describe the texture of three objects presented during the activity.

MATERIALS

cardboard or oaktag shape
senses cards
three "feely" objects
strips of colored paper
three "smelly" objects
"stop sign"

MAJOR CONCEPTS

Environmental Awareness

GRADE

Pre-school—1

TIME

1 to 1.5 hours

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

Discuss the five senses and how we use them to learn. Make "Touchy-Feely" boxes (Project Learning Tree, Elementary Curriculum Guide, Activity #11) and "Smelly" containers (use mustard or ketchup squeeze bottles, plaster of paris, and oils, essences, etc. to impregnate plaster of paris.) Have a senses corner; have students describe textures, smells, weights, etc. Change contents of boxes periodically.

Field Activity

1 Today we are going to explore the forest. To help us explore we are going to use our senses. What are our senses? How many do we have? Review the five senses with the students. Have them locate which part of the body is used for which sense and what each sense helps us do. Caution them they they will not be doing any tasting and why.

2 Does everyone know what this sign is? (stop sign) What does a stop sign mean? As we go through the forest and I put up this sign what do you think we should do? When I put up the stop sign we are going to stop and discover something new. Let's go.

3 Stop sign! I am going to show a color (red, green, yellow, brown, orange, white). What color is it? Can you find something the same color as this? After everyone has found something form a sharing circle, and compare the colored paper to the colors of the objects they found. Are they the same? You may want to talk about lighter and darker colors. Repeat this procedure with two other colors.

4 Stop sign! I am going to show you a shape (circle, triangle, square, rectangle). Can you find something the same shape as mine? Form a sharing circle after all the students have made their discoveries. Compare their shapes to your shape. Are they the same? Repeat this procedure for two other shapes.

5 Stop sign! Let's form a circle (sit down if it is dry). I am going to give each of you an object. You should feel it in your hands and think how you would describe how it feels. But don't talk! Everyone close your eyes. Give each student one of the objects. After a short time for examination have them open their eyes, keeping their objects in their hands so no one can see it. Have them describe how their objects feel. What is it? Have them open their hands to examine their objects. Repeat the procedure with two other objects.

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6 Stop sign! Let's form another circle. This time I'm going to give you something to smell. What do we use to smell? Now close your eyes; here we go. Pass a fragrant natural object among the group. How do the students describe the smell? Repeat the procedure with another object, or if you are in the right area have them take a deep breath!

7 Stop sign! Let's form our circle, close our eyes, be quiet and listen! (30-60 seconds) What did the students hear? Facilitator's note: The stop sign activity sequence may be changed or smells, sounds, etc. experienced at more than one stop to take advantage of the "teachable moment."

8 Stop sign! Now we are going to play tag, but a little differently than the way you usually play tag. Each person that is "it" will get a card. The card will tell you what to do. (The cards might include: Find something wet, dry, rough, smooth, heavy, light; red, black, orange, green, brown; a circle, a square, a triangle; smells woody, earthy, etc.) If you are "it" and find what is on your card, you can then tag someone else to be "it." I'll go first. Repeat for as many people or cards as time allows.

Follow-Up Activity

- Have students bring in materials for the touchy-feely boxes. Can they fool their classmates?
- Visit the area around the school. How are smells, sounds, sights, and textures different here than in the forest? How are they the same?

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The Weather Around Us

UNIT CONCEPTS

- Weather is the condition of the atmosphere at a given time in relation to pressure, wind, heat and moisture.
- The sun's energy is the driving force for our weather and climate.
- The weather can be measured with various instruments. These measurements can be used to predict weather.

OBJECTIVES

- Measure and record the temperature, humidity, precipitation, barometric pressure and direction, wind speed and direction, and the time.
- Based on the meteorologic measurements and observations, make a 24-hour weather forecast.

MATERIALS

thermometer
rain gauge
anemometer
paper
lapboard
compass
maximum-minimum thermometer
psychrometer
barometer
wind vane
pencil
cloud chart

MAJOR CONCEPTS

Energy
Cycles

GRADE

5 - 6

TIME

1 hour

SEASONS

Spring
Summer
Fall
Winter

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Lead-Up Activity

Have students record weather forecasts from the newspaper, television and radio each day for a week. Have them also record the actual weather for each day. Which forecasts were most accurate? Why do you think this was true?

Field Activity

1 How many people watch the weather forecaster on television? Are the forecasts accurate? Is s/he right all the time? Did you ever wonder how predictions are made? Today you are going to measure the weather and make a weather prediction. Tommorrow you will find out if you are as good of a weather predictor as the weather forecaster.

2 What types of measurements does the weather forecaster take to make predictions? (temperature, moisture, wind direction, wind speed and atmospheric pressure.) Let's look at and measure them.

3 What is temperature? (Temperature is the degree of hotness or coldness of something.) What causes things to be hot or cold? (the sun's energy and its angle in the sky) What is used to measure temperature? Are all thermometers the same? What is the temperature today? Do you think it's the same temperature at your home, school, at the seashore, at the mountains? Why? Look at the maximum-minimum thermometer. What is the highest temperature recorded? The lowest? When do you think these temperatures occurred? What caused these differences? What effect does temperature have on the weather? Record the present temperature.

4 There are two types of moisture measured in conjunction with the weather. One is precipitation. What forms may precipitation take? (rain, snow, sleet, hail, freezing rain) Look at the rain gauge. Has there been any precipitation lately? What type? How much? Why would you want to know how much rain or snow had fallen? Where does precipitation come from? Are there any clouds today? Are there more than one kind? Can the clouds help us predict the weather? (Refer to cloud chart.)

5 The other measure of moisture in the air is humidity. What is humidity? (Humidity is the amount of moisture in the air compared to the amount of moisture the air could hold at that temperature.) Relative humidity may be measured with a sling psychrometer. The sling psychrometer consists of a dry-bulb and a wet-bulb thermometer which are fixed side-by-side. The dry-bulb thermometer is covered with a layer of cloth which is dampened with pure water. The sling psychrometer is then slung through the air. The evaporation of water from the wet-bulb thermometer will lower its temperature. The relative humidity is determined by the difference between the dry-bulb and wet-bulb temperature readings. Refer to Chart 1—Relative Humidity. Determine and record the relative humidity using the sling psychrometer. What effect does relative humidity have on the weather? and us? (may help result in thunderstorms, and high humidity makes us feel uncomfortable)

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Chart 1—Relative Humidity

Difference between dry bulb and wet bulb °F

Air Temperature °F	1	2	3	4	5	8	10	12	14	16	18	20	25	30
0	67	33	1											
5	73	46	20											
10	78	56	34	13										
15	82	64	46	29										
20	85	70	55	40	12									
25	87	74	62	49	25	1								
30	89	78	67	56	36	16								
35	91	81	72	63	45	27	10							
40	92	83	75	68	52	37	22	7						
45	93	86	78	71	57	44	31	18	6					
50	93	87	80	74	61	49	38	27	16	5				
55	94	88	82	76	65	54	43	33	23	14	5			
60	94	89	83	78	68	58	48	39	30	21	13	5		
65	95	90	85	80	70	61	52	44	35	27	20	12		
70	95	90	86	81	72	64	55	48	40	33	25	19	3	
75	96	91	86	82	74	66	58	51	44	37	30	24	9	
80	96	91	87	83	75	68	61	54	47	41	35	29	15	3
85	96	92	88	84	76	70	63	56	50	44	38	32	20	8
90	96	92	89	85	78	71	65	58	52	47	41	36	24	13
95	96	93	89	86	79	72	66	60	54	49	44	38	27	17
100	96	93	89	86	80	73	68	62	56	51	46	41	30	21

Chart 3—Beaufort Scale of Wind Force

Beaufort Number	Observation	m.p.h.
0	Calm, smoke rises vertically	less than 1
1	Direction of wind shown by smoke drift but not wind vane	1 - 3
2	Wind felt on face, leaves rustle, ordinary vane moved by wind	4 - 7
3	Leaves and small twigs in constant motion, wind extends light flag	8 - 12
4	Raises dust and light paper, small branches are moved	13 - 18
5	Small trees in leaf begin to sway, crested wavelets form on inland waters	19 - 24
6	Large branches in motion; whistling heard in telephone and electric wires, umbrellas used with difficulty	25 - 31
7	Whole trees in motion; inconvenience felt in walking against wind	32 - 38
8	Breaks twigs off trees, generally impedes progress	39 - 46
9	Slight structural damage occurs	47 - 54
10	Seldom experienced inland, trees uprooted, considerable structural damage	64 - 75

Chart 2 — Barometer and Wind

Wind direction change	Sea level barometric pressure	Indicated weather
SW to NW	30.10 to 30.20 and steady	Fair, with slight temperature changes for 1 to 2 days.
SW to NW	30.10 to 30.20 and rising rapidly	Fair, followed within 2 days by rain.
SW to NW	30.20 and above and stationary	Continued fair, with no decided temperature change.
SW to NW	30.20 and above and falling slowly	Slowly rising temperature and fair for 2 days.
S to SE	30.10 to 30.20 and falling slowly	Rain within 24 hours.
S to SE	30.10 to 30.20 and falling rapidly	Wind increasing in force, with rain within 12 to 24 hours.
SE to NE	30.10 to 30.20 and falling slowly	Rain in 12 to 18 hours.
SE to NE	30.10 to 30.20 and falling rapidly	Increasing wind, and rain within 12 hours.
E to NE	30.10 and above and falling slowly	In summer, with light winds, rain may not fall for several days. In winter, rain within 24 hours.
E to NE	30.10 and above and falling rapidly	In summer, rain probable within 12 to 24 hours. In winter, rain or snow with increasing winds will often set in when the barometer begins to fall and the wind sets in from the NE.
SE to NE	30.00 or below and falling slowly	Rain will continue 1 to 2 days.
SE to NE	30.00 or below and falling rapidly	Rains, with high wind, followed within 36 hours by clearing, and in winter by colder.
S to SW	30.00 or below and rising slowly	Clearing within a few hours, and fair for several days.
S to E	29.80 or below and falling rapidly	Severe storm imminent, followed within 24 hours by clearing, and in winter by colder.
E to N	29.80 or below and falling rapidly	Severe NE gale and heavy precipitation; in winter, heavy snow followed by a cold wave.
Going to W	29.80 or below and rising rapidly	Clearing and colder.

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6 What is pressure? (Pressure is the amount of force per unit area pushing on a plane surface.) When we measure pressure in regard to weather what do you think we are measuring? (We are measuring the pressure of air pushing down on the ground.) Pressures tend to equalize themselves. High pressure shows what? (There is more air pushing down at that spot.) Low pressure shows what? (There is less air pushing down at a spot.) Since pressure tends to equalize itself, what do you think happens between high pressure areas and low pressure areas? (Air moves from high pressure areas to low pressure areas.) What do these pressure differences create? (Winds are created by the pressure differences; the greater the difference the stronger the winds.) How is pressure measured? (with a barometer) A barometer is a 33-inch tube placed over a dish of mercury. At sea level the mercury will flow from the dish up the tube to the 30-inch mark. If air pressure increases the mercury is pushed higher in the tube. If air pressure decreases the mercury drops in the tube. Besides knowing at what level the mercury is in the tube you must also know whether the barometer is rising or falling. What do you think a falling barometer indicates? A rising barometer? Record the barometric pressure and whether it is rising or falling. Refer to Chart 2—Barometer and Wind to help you in your weather prediction.

7 What is one element we talked about that helps create winds? What do you think causes these pressure differences? (Unequal heating of earth. Winds redistribute an excess of heat in the tropics to the polar regions which have a heat deficit. If this were not true the tropics would become hotter and hotter, the polar regions cooler and cooler.) The wind is further affected by local influences. What instrument measures wind speed? (An anemometer. If an anemometer is not available, see Chart 3—Beaufort Scale of Wind Force. Of what value is it to know wind speed? (gives an indication of pressure changes and potential wind damage) Besides knowing wind speed, it is important to know wind direction. What is used to measure wind direction? (a wind vane) Why is it important to know the direction the wind is coming from? (Depending on the time of year, wind direction gives an indication of coming weather.) Record the direction the wind is from and its speed. Look at Chart 2. Weather predictions are based on many factors.

8 Based on your observations of the sky and your measurements, make a weather prediction. Is your prediction good everywhere? How does weather affect the environment?

Follow-Up Activity

- Check the weather prediction. Were you right?
- Construct your own weather instruments and set up a weather station at your school.
- Read about weather sayings and myths. Are they accurate? How do you think each developed?

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